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OBSERVATIONS ON THE GENUS ACROSPERMUM[1]

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(WITH PLATE 11, CONTAINING 13 FIGURES)

Acrospermum is the name given to a small group of closely related fungi growing on living or dead herbaceous plants or plant-parts. The genus was established in 1790 by Tode in his Fungi Mecklenburgenses (part 1, page 8), with *Acrospermum compressum* as the type-species. The plants all have erect fructifications, more or less clavate or spatulate in form. The asci are elongated; contain eight filiform, colorless spores; and are surrounded by capillary paraphyses. The texture is horny when dry, fleshy-cartilaginous when moist. There are two peculiarities which have made the systematic position of the genus uncertain: the fructification is ordinarily compressed (compare Figs. 1 and 2), and the ostiole is elliptical rather than circular (Fig. 5). Ellis and Everhart (North American Pyrenomycetes p. 67, 1892) placed *Acrospermum* in the Hypocreales, to which it is obviously allied in texture and in the coloration of most of the species. Rehm, however, transferred the genus to the Hysteriales, because of the two peculiarities mentioned above, and this disposition has been accepted by Lindau, in Engler and Prantl, where he established a family, Acrospermaceae, in the Hysteriales.

Such an arrangement seems scarcely to express natural relationships since all of the Hysteriales are characteristically car-

[1] Contribution from the Cryptogamic Laboratories of Harvard University, No. 88.

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bonaceous and open by a cleft rather than by an elliptical ostiole. In order to determine whether the internal structure might throw light on the true systematic position of the genus, microtome sections of *Acrospermum compressum* and of a new species have been studied and have yielded certain results of interest. Reference to figure 11 will show that the lower part of the fructification is occupied by sterile tissue. This is more or less prosenchymatous in nature, differing from the substance of the wall and reminding one of the hypothecium or trama of a normal apothecium. Nevertheless, this does not necessarily indicate discomycetous affinities, for a similar structure is found in the perithecium of some Pyrenomycetes, for example *Bombardia fasciculata* Fr. Figure 12 illustrates the apical portion of the fructification somewhat more enlarged. It will be noticed that the paraphyses do not form a definite hymenium such as would be found in the Hysteriales, but that they converge loosely toward the ostiole rather in the manner of various Pyrenomycetes. Taking this into account together with the texture, and with the facts that a compressed form and elongated ostiole are found in the Lophiostomaceae, and a sterile basal tissue in *Bombardia* and other genera, it would seem to the writer that the natural conclusion is to consider the fructification a perithecium and to follow Ellis in placing the Acrospermaceae not under the Hysteriales but under the Hypocreales.[2]

Material distributed in the principal exsiccati under the specific name *Acrospermum compressum* Tode shows considerable variation (compare Figs. 7–10). The size varies from 0.8 to 2.5 millimeters. The form varies from spatulate, with the apex almost truncate (Fig. 8) to clavate with an obtuse apex (Fig. 10). The figures cited show a corresponding variation in the development of the stipe: in such perithecia as are figured in Nos. 7 and 8 there is merely a slight contraction below, scarcely to be referred

[2] Owing to delay in the receipt of German journals, because of the war, the present paper was in print before the writer saw a note by Von Hoehnel in the *Annales Mycologici* (15: 379. 1917), in which he expresses the view that *Acrospermum* is undoubtedly one of the Pyrenomycetes. Von Hoehnel believes that the characters in common with *Bombardia* indicate true relationship, and after naming two probable connecting links, he places *Acrospermum* in the Sordariaceae.

to as a stipe; while in the specimens distributed in Libert Plantae Cryptogamicae Arduennae No. 32 and in the Kryptogamae Exsiccatae Vindobonenses No. 1435, there is a well-defined stipe, cylindrical and of considerable relative length (Fig. 10). The surface varies from even (Fig. 7) to wrinkled (Fig. 8), and longitudinally furrowed (Fig. 10). The color is typically bay-brown,[3] but varies to seal-brown, snuff-brown, and russet; rarely (*e.g.*, Berkeley's British Fungi Exsiccati No. 270) it may be dull fuscous-black. The color of any given perithecium is usually fairly uniform throughout, but occasional specimens are seen (*e.g.*, Mougeot and Nestler Stirpes Cryptogamae Vogeso-Rhenanae No. 671), where the color becomes gradually paler toward the apex.

Connecting with the typical form of the species and distinguishable only as varieties are two plants which have been described as distinct species. The first of these is *Acrospermum graminum* Libert, usually smaller than *A. compressum*, somewhat darker in color, with a linear outline, and growing on dead leaves of grasses (Fig. 5). Rehm has already reduced this to varietal rank.

The second plant is *Acrospermum foliicolum* Berk. Authentic specimens in the Curtis Herbarium show that in size and in shape, Figs. 9 and 10 would represent this plant as well as the typical form of *A. compressum*. The color of *A. foliicolum* is in general lighter than that of *A. compressum*, being from honey-yellow to russet. But it will be noticed that darker specimens of the former coincide in color with lighter specimens of the latter. The only constant difference that the writer has been able to discover between the two forms is the habitat: all specimens of *A. compressum* that have been seen grow on stems, while all the specimens of *A. foliicolum* grow on Dicotyledonous leaves. This would scarcely seem to be of sufficient importance to maintain a specific difference between the two.

The variations of *Acrospermum compressum* may be summarized as follows:

ACROSPERMUM COMPRESSUM Tode Fungi Mecklenb. 1: 8, *t. 2, f. 13.* 1790.

[3] All color terms in this paper are taken from Ridgeway: Color Standards and Nomenclature. 1912.

a. forma typica. On herbaceous stems; 1–2.5 mm. in height, more or less contracted below, bay-brown. Widely distributed in the United States.

b. var. GRAMINUM (Lib.) Rehm in Rabenh. Krypt. Fl. Deutschl. 1^3: 55. 1887.

Acrospermum graminum Libert Pl. Crypt. Ard. fasc. 1, No. 33. 1830, cum descript.

On dead leaves of grasses; 0.4–1.0 mm. in height, linear in outline, chocolate to warm brownish-black. Recorded in the United States from New York, Missouri, and California.

c. var. **foliicolum** (Berk.) Riddle comb. nov.

Acrospermum foliicolum Berk. Grevillea 4: 161. 1876.

On dead leaves of *Celtis, Cornus, Ulmus,* etc.; 0.7–1.5 mm. in height, stipitate, honey-yellow to russet. Apparently confined to the warmer portion of the United States: specimens examined from New Jersey, North and South Carolina, Louisiana, Texas; and recorded from Alabama.

In 1914, Mr. W. R. Maxon, of the United States National Herbarium, sent to Dr. W. G. Farlow specimens of an *Acrospermum* growing on the living fronds of a tropical fern. In the accompanying letter (Oct. 14, 1914), Mr. Maxon says: "I am sending you herewith two specimens of *Polypodium induens* Maxon, these being my 2770 from Jamaica and my 5486 from Panama, both of which seem to be affected with a fungus. I have never seen anything like it, and it seems to me a curious coincidence that what appears to be the same organism should occur upon individuals of the same species from widely separated regions." In a subsequent letter (Dec. 11, 1914), Mr. Maxon adds: "I have gone over all of the material of *P. induens* and find the fungus occurring upon nearly every collection of it." Dr. Farlow recognized that the material represented a new species and named it in honor of Mr. Maxon, labeling the specimens in the herbarium accordingly. No description was published, however, and after Dr. Farlow's death, Mr. Maxon called the present writer's attention to the plant, and suggested the publication of some account of it.

This new species may be described as follows:

Acrospermum Maxoni Farlow in herb. sp. nov.

(Plate II, Figures 1–5)

Perithecia solitaria dispersa aut rarius geminata, superficialia erecta, 0.7–1.3 mm. altit., 0.22–0.3 mm. latit., clavata compressa; apice rotundato vel obtuso; infra in stipitem tenuem cylindricem attenuata, stipite 0.2–0.27 mm. altit., 0.07–0.09 mm. diam.; primitus clausa dein ostiolo ellipsoideo aperta; siccis coriaceis, madefactis carneo-cartilagineis; fusco-nigra nitida, apice argillaceo; basi mycelio distincto irregulare rotundato arachnoideo circumcincto, centro fusco, margine stramineo. Asci 8-spori anguste cylindrices elongatae, circa 400 μ longi, 5 μ lati; sporidiis hyalinis filiformibus irregulariter flexuosis haud spirale contortis. continuis, parum brevioribus quam ascis, circa 1 μ latis. Paraphyses copiosae capillariae.

On the under side of living fronds of *Polypodium induens* Maxon, in humid forest, Chiriqui, Panama, March 18, 1911, collected by W. R. Maxon, no. 5486*a* (type); same locality, no. 5714*a*; vicinity of Coliblanco, Costa Rica, May 1, 1906, no. 278*a*; vicinity of Morce's Gap, Jamaica, June 23, 1904, no. 2770*a*; Apr. 18, 1903, no. 1214 *a*; Sir John's Peak, Jamaica, no. 1324 *a*, all collected by W. R. Maxon. Forests of Santa Rosa du Copey, Costa Rica, April, 1898, collected by Tonduz, without number.

On *Polypodium cretatum* Maxon, Monkey Hill, above New Haven Gap, Jamaica, June 22, 1904, collected by W. R. Maxon, nos. 2702*a*, 2754*a*; Sir John's Peak, Jamaica, Sept. 1906, collected by L. M. Underwood, no. 3203*a*.

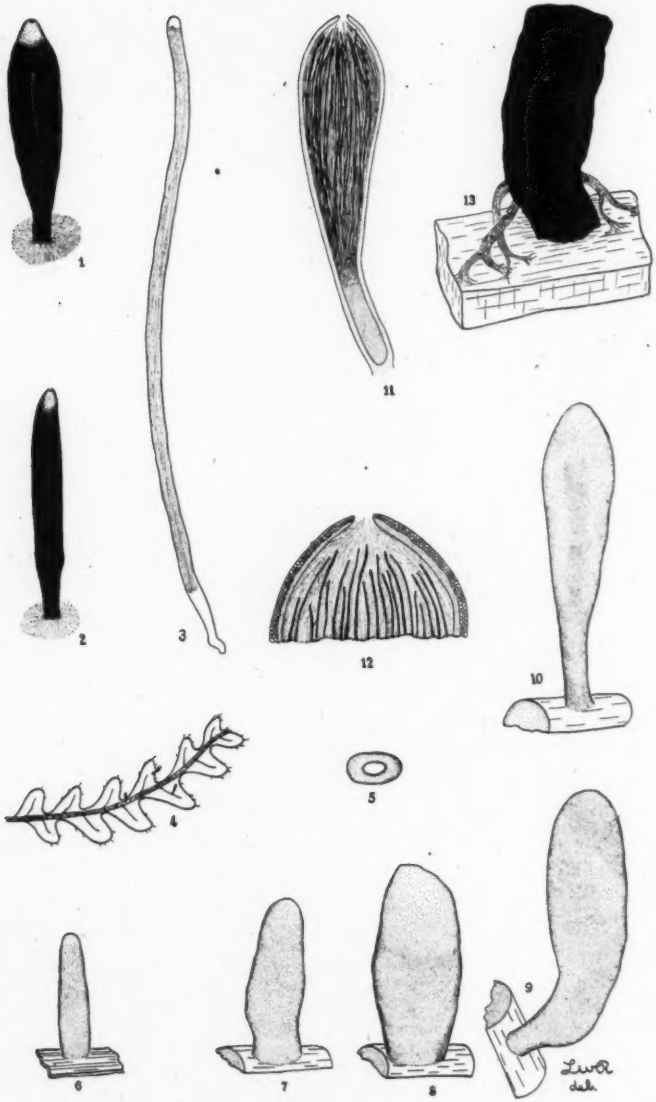
Acrospermum Maxoni differs from *A. compressum* in the contrast between the *shining* black perithecia and the clay-colored tips; in the peculiar mycelial web, surrounding the base of the perithecium; and in the habit of growing on living ferns. These characters distinguish it also from *A. Puiggarii* Spegazzini (Bol. Acad. Nac. de Ciencias de Cordoba **23**: 121. 1919) described as growing over mosses in Brazil and as having black perithecia, becoming pallid toward the base. *Microstelium hyalinum* Patouillard (Bull. Soc. Myc. France **15**: 208. *pl. 9, f. 1.* 1899), encrusting algae and mosses on tree-trunks in Guadeloupe, is said by

its author to be related to *Acrospermum;* and Lindau in the "Nachtraege" to Engler and Prantl's Naturlichen Pflanzenfamilien I[1]. 1900, places it in the Acrospermaceae. According to Patouillard's original description, his plant has a superficial mycelium somewhat similar to the mycelial web of *Acrospermum Maxoni,* but also has the perithecium covered with a filamentous "trama."

In 1881, Ellis (Bull. Torrey Bot. Club **8**: 124) described a fungus from Utah under the name *Acrospermum corrugatum.* In 1884 the same fungus was found in California by Harkness and named by him *Acrospermum fultum* (Bull. Calif. Acad. **1**: 47). An examination of material issued in Ellis and Everhart's North American Fungi Series II, no. 2055, shows that this species has marked peculiarities which distinguish it clearly from all Acrosperma, as the following comparison will indicate:

Typical *Acrospermum*	*"Acrospermum corrugatum"*
Texture fleshy-cartilaginous.	Texture carbonaceous.
Corrugations occasionally present in dried specimens, but disappearing upon moistening.	Corrugations strongly marked and persistent even when moist.
Ostiole merely elliptical.	Ostiole an elongated, narrow cleft.
Growing on herbaceous plants or plant-parts.	Growing on dead wood.

Since *"Acrospermum corrugatum"* does not possess the typical and characteristic features of a true *Acrospermum,* it became evident that it should be excluded from the genus. Further study led to the discovery that Ellis' plant is identical with the long-known but comparatively rare European species: *Lophium dolabriforme* Wallr. (Flora Crypt. Germ. **2**: 433. 1833) not hitherto recognized from the American continent. In addition to the characters already noted, all of the descriptions of *Lophium dolabriforme* emphasize the peculiar rope-like, mycelial strands around the base of the apothecium (see Fig. 13) and these are well shown in the specimens issued in Vestergren Micromycetes Rariores Selecti no. 921. In addition to the Utah and California stations, Rostrup (Medd. on Groenl. **18**: 61. 1894) has recorded



ACROSPERMUM

this plant from Greenland. And in 1905, Dr. Roland Thaxter collected it at Punta Arenas, Chile, in the Straits of Magellan.

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EXPLANATION OF PLATE 11

All of the figures, with the exception of nos. 3, 4, 5, and 12, were drawn to the same scale with a Spencer Lens Company 5-x eye-piece and 16 mm. objective; and have been reduced about one third in reproduction.

Figs. 1–5. *Acrospermum Maxoni* Farlow.

1. Perithecium, face view, with mycelial web at base.
2. Perithecium, side view.
3. Single ascus, with spores.
4. Habit, enlarged about 2 ×.
5. Apex of perithecium cut off and viewed from above to show the elliptical ostiole.

Fig. 6. *Acrospermum compressum* var. *graminum* (Libert) Rehm, from Rabenhorst Fungi Europaei Exsiccati no. 776.

Figs. 7–12. *Acrospermum compressum* Tode.

7. Ex herb. Fuckel in herb. Farlow.
8. Ellis North American Fungi no. 1318.
9. Klotzsch Herbarium Vivum Mycologicum no. 738.
10. Libert Plantae Cryptogamicae Arduennae no. 32.
11. Longitudinal section of entire perithecium from Kryptogamae Exsiccatae Vindobonenses no. 1435. Diagrammatic.
12. Apical portion of some, more enlarged. Semi-diagrammatic.

Fig. 13. *Lophium dolabriforme* Wallr. from specimen collected by R. Thaxter in Chile.

NEW SPECIES AND RELATIONSHIPS IN THE GENUS COLEOSPORIUM

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A study of the species of the form genus *Peridermium* occurring on the needles of pines in the United States, and of their relation to the various species of *Coleosporium* in the same range was begun by the senior writer in 1912. He has since been assisted in this work as follows: by William H. Long in 1914, by N. Rex Hunt from 1915 to 1918, and by Glenn G. Hahn in 1919 and 1920. All collections cited in this paper without the name of the collector were made by the senior writer; where made by others the name of the collector is given. This paper gives some of the results of the more critical sets of inoculations made with several species, chiefly during the past three years.

In the descriptions of fungi given in this paper, all measurements for averages are based upon either 50 or 100 individual measurements. Materials for study are prepared as follows: dried specimens are first placed in water, then heated to the boiling point, transferred to a 10 per cent. gum arabic solution for 15 minutes and sectioned with a freezing microtome. Sections are mounted in a solution of 30 per cent. glycerine in water tinged with erythrosin. Measurements of the sori of pycnia and aecia in length and width are taken chiefly from unsectioned dry material. Measurements of cell walls are the estimated median for the side walls of each cell and include wall papillae. The colors of pycnia, aeciospores, and peridia are based on fresh material.[1] As has already been pointed out (7),[2] the color in fresh pycnia furnishes a good diagnostic character. Pycnia when old fade, and although this feature loses in value with age, other characters still hold, such as arrangement on the leaves, and size.

[1] Colors used are those of R. Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912.

[2] Numbers in parentheses refer to publications cited at the close of the paper.

All type specimens for the species described in this paper are deposited in the Pathological Collections of the United States Department of Agriculture, Washington, D. C. The numbers given with collections apply to collections for study in the Office of Investigations in Forest Pathology, Washington, D. C.

COLEOSPORIUM APOCYNACEUM

On March 27, 1918, near Silver Springs, Florida, a beautiful *Peridermium* with delicate fimbriate peridia was collected from the needles of *Pinus caribaea*,[3] *P. palustris*, and *P. taeda*, in direct association with plants of *Amsonia ciliata*[4] bearing the uredinia of *Coleosporium apocyraceum* Cooke, which were evidently from a recent infection. Inoculations were made April 3, 1918, by Hunt on six plants of *Amsonia ciliata* at Washington, D. C., in a greenhouse, with the aeciospores of the *Peridermium* from *Pinus taeda*. On April 15, the uredinia of *Coleosporium apocynaceum* Cooke appeared on the leaves of one plant, and later the telia, establishing that this *Peridermium* is the aecial stage of *Coleosporium apocynaceum* (10). Hedgcock repeated this inoculation on plants of *Amsonia ciliata* May 27, 1918, with aeciospores from a collection of the *Peridermium* from *Pinus palustris* at Silver Springs, May 7, 1918. Uredinia appeared on two plants June 9, and a month later telia were formed. Control plants in both these experiments remained free from the rust. Inoculations made with urediniospores on plants of *Amsonia ciliata* April 24 and May 24, 1918, resulted in the production of uredinia May 8 and June 9, respectively and of telia about a month later.

The aecial stage of *Coleosporium apocynaceum*, for convenience in distinguishing it from other species of the form genus *Peridermium*, is here named **Peridermium apocynaceum** (Cooke) Hedgc. & Hunt, comb. nov., with the following description:

Pycnia, amphigenous, scattered, in one row on each side of the leaf, conspicuous, on chlorotic spots, dehiscent by a longitudinal slit, hazel-brown to chestnut-brown, 0.4–0.8 mm. wide, 0.6–1.4

[3] The name of forest trees used in this paper are those recognized by Geo. B. Sudworth in various publications of the Forest Service, Washington, D. C.

[4] The names of herbaceous plants and of shrubs are those recognized by J. K. Small, Flora Southeastern United States, 1913.

mm. long, and 0.1–0.2 mm. high, averaging 0.5 by 0.85 by 0.16 mm.; pycnospores 2–3 by 4–7 μ, averaging 2.4 by 5 μ.

Aecia from a limited mycelium, amphigenous, one to several in a single row usually on the inner sides of the leaves, on chlorotic spots, occasionally confluent, flattened laterally, rectangular before rupturing, 0.26–0.5 mm. wide, 2–20 mm. long, and 0.25–0.45 mm. high, after rupture, averaging 0.35 by 6.1 by 0.35 mm.; peridium thin, rupturing circumscissally, the ruptured edges recurved and lacerated or irregularly fringed, fragile; peridial cells ellipsoid to cylindric, occasionally clavariform, 18–33 μ wide, 25–63 μ long, averaging 23 by 42 μ, slightly overlapping but loosely adherent, with walls 2–6 μ thick, averaging 4.4 μ, outer walls thicker than inner, both verrucose with cylindric papillae 1–2 μ in diameter by 2–6 μ in length, averaging 1.3 by 3.8 μ; aeciospores ovoid to ellipsoid, occasionaly pyriform, 16–23 by 22–42 μ, averaging 19.1 by 31.5 μ, contents orange, fading when old, walls 3–6 μ thick, averaging 4.7 μ, verrucose with short, blunt tubercles 2–4 μ in diameter and 2–6 μ long, averaging 2.6 by 3.9 μ.

Coleosporium apocynaceum Cooke has been collected in the United States only as follows:

O. and I. On *Pinus* near Ocala, Florida:

P. caribaea, in 1918, March 27 (25212) and April 7 (29101).

P. palustris, in 1918, March 27 (25214, type collection), April 7 (29100); in 1919, February 27 (32141) and May 15 (32379).

P. taeda, in 1919, March 27 (25213) and May 15 (32384).

II and III. On *Amsonia:*

A. amsoniae, South Carolina, in 1860, by H. W. Ravenel, Pinopolis (Fungi Caroliniani Exsiccati, 489); Alabama, in 1864, by T. M. Peters (Peters Collection, University of Alabama); in 1896, by F. S. Earle and L. M. Underwood, Auburn, Alabama, July (Flora Alabama).

A. ciliata, South Carolina, in 1852, by H. W. Ravenel, Aiken (Fungi Caroliniani Exsiccati 44); in 1916, by G. G. Hedgcock, Clearwater, September 27 (24102); Florida, in 1918, Silver Springs, Ocala, March 27 (25215), May 7 (25299), May 24 (25284 & 29116); and in 1919, May 15 (32378).

COLEOSPORIUM LACINIARIAE

Arthur first described the uredinia and telia of *Coleosporium laciniariae* in 1907 (1), reporting it from specimens of *Laciniaria*

graminifolia from Auburn, Alabama. He also mentioned its occurrence on *L. chapmani* in Florida. Since 1907, the known range of this species of *Coleosporium* has been greatly extended and a number of additional hosts found (6).

Peridermium fragile Hedgc. and Hunt (7) was first recognized in Florida at Brooksville on the needles of *Pinus palustris*, March 11, 1915. Numerous inoculations were made by Hedgcock and Hunt during 1915, 1916 and 1917 with the aeciospores of this *Peridermium* on many plants of species of *Aster, Chrysopsis, Elephantopus, Euthamia, Laciniaria, Pharbitis, Solidago, Verbesina* and *Vernonia*, without results. The plants of *Laciniaria* used were in poor condition. In the autumn of 1916, the collection of *Coleosporium laciniariae* on plants in direct association with pine trees which earlier in the season were infected with *Peridermium fragile*, indicated that *Laciniaria* was the alternate host genus for this species of *Peridermium*. Good thrifty plants of *Laciniaria* were secured and kept in stock. On March 20, 1918, Hunt inoculated the leaves of several species of *Laciniaria* with the aeciospores of this *Peridermium* from *Pinus palustris* (25135) at Ocala, Fla., March 15, 1918. One plant of *Laciniaria graminifolia* was infected, uredinia appearing April 11, and telia later. On March 4, 1919, Hedgcock inoculated one plant of *Laciniaria* sp. with aeciospores collected from *Pinus palustris* at Ocala, Fla., February 27. On March 22, uredinia appeared on the leaves. Telia were noted June 5. In both experiments control plants remained free from the rust. This proves that *Peridermium fragile* Hedgc. and Hunt is the aecial stage of *Coleosporium laciniariae* Arthur.

Coleosporium laciniariae Arthur has been collected as follows, the data being taken from collections in this office.

O and I. On *Pinus:*

P. palustris, Florida, in 1915, Brooksville, March 11 (17426, type of *Peridermium fragile*), March 11 (17427), March 12 (17430); in 1916, March 17 (20780, 20781, 20786 and 20787); in 1918, March 17 (25163); in 1919, March 2 (32161 and 32162), March 3 (32172); May 15 (32465); Ocala, in 1916, March 16 (20775); in 1918, March 15 (25135); in 1919, February 28

(32153); in 1919, Gainesville, March 20 (20806); in 1919, Lake City, March 12 (32231); Georgia, in 1915, Waycross, April 1 (17594).

P. rigida, New Jersey, in 1916, Pleasantville, June 5 (22347); Mount Calvary, June 5 (22348); in 1917, Mount Calvary May 12 (26522); District of Columbia in 1917, Washington, May 31 (24522).

II and III. On *Lacinaria:*

L. elegans, Florida, in 1915, Ocala, October 27 (20073); Jacksonville, October 30 (20085).

L. elegantula, Alabama, in 1915, Auburn, October 7 (18895).

L. gracilis, Florida, in 1915, Lake City, October 25 (20057); Brooksville, October 28 (20077).

L. graminifolia, New Jersey, in 1915, Pleasantville, September 12 (17952); in 1916, Mount Calvary, September 2 (22762, 22763, 22764, 22765, 22766, 22767 and 22768); in 1917, September 18 (22620).

L. laxa, Florida, in 1915, Tampa, October 29 (20082).

L. squarrulosa, Arkansas, in 1915, Bald Knob, October 12 (18890); Tennessee, in 1916, Big Frog Mountain, September 21 (22864); Georgia, in 1916, Atlanta, September 24 (22958).

L. tenuifolia, Florida, in 1915, Lake City, October 25 (20058); Tampa, October 29 (20081); Jacksonville, October 30 (20086).

From these data, it will be seen that our known range of *Coleosporium laciniariae* is from New Jersey to Florida and Arkansas.

PERIDERMIUM MINUTUM

Peridermium minutum Hedgc. and Hunt (7) is a small species of leaf *Peridermium* known only from Florida. It was first collected at Brooksville in 1915, and again in 1916 in the same locality and also at Gainesville. Repeated attempts without result were made in 1916 to infect plants withthe aeciospores of this rust, using species of *Aster, Campanula, Calonyction, Coreopsis, Chrysopsis, Elephantopus, Helianthus, Ipomoea, Laciniaria, Parthenium, Pharbitis, Quamoclit, Silphium, Solidago, Verbesina* and *Vernonia.* On May 6, 1918, near Gainesville, Fla., the uredinia of a *Coleosporium* were found occurring abundantly on the leaves

of *Adelia ligustrina* under a tree of *Pinus glabra* heavily infected with *Peridermium minutum*. Healthy plants of *Adelia ligustrina* secured from another locality were packed in direct contact with fresh aecia of this *Peridermium*, mailed to Washington, D. C., and placed in pots. The uredinia of the *Coleosporium* appeared on these plants in about two weeks after they were potted, and later telia. On March 28, 1919, inoculations were made again in the greenhouse at Washington, D. C., on eight healthy plants of *Adelia ligustrina* with the aeciospores of the Peridermium collected on *Pinus glabra* at Gainesville, Fla., February 28, 1919. Uredinia of the Coleosporium appeared on the leaves of three plants April 14, and telia about June 1; six control plants remained free from the rust. This proves that it is the alternate stage of *Peridermium minutum* (10). This species of *Coleosporium* with minute sori differs from other known species of this genus, and is now given the name **Coleosporium minutum** Hedgc. and Hunt, comb. nov., with the following description:

Uredinia hypophyllous, numerous, small, scattered on slightly chlorotic areas on the leaves, circular to elliptic, 0.1–0.5 mm. in diameter, averaging 0.25 mm., orange-chrome, fading with age to white, ruptured epidermis inconspicuous; urediniospores sphaeroid to obovoid or ellipsoid, 15–23 by 18–31 μ, averaging 18.7 by 24.5 μ, walls irregularly thickened at the apex, 2–8 μ thick, averaging 4.9 μ verrucose with coarse conical tubercles, 2–4 μ in diameter, averaging 2.6–3.8 μ.

Telia hypophyllous, small, scattered or somewhat gregarious, rarely confluent, circular to elliptic in outline, 0.16–0.36 by 0.18–0.36 mm., averaging 0.22 by 0.26 mm., grenadine red, darkening with age; teliospores with wall swelling 20–36 μ above, averaging 24.2 μ; contents orange-chrome, fading to almost colorless, cylindric to clavate or oblong, 18–32 by 30–70 μ, averaging 23.1 by 44.9 μ, rounded or obtuse at the apex, obtuse to narrowed below.

Coleosporium minutum Hedgc. and Hunt has been collected in the United States only and as follows:

O and I. On *Pinus:*

P. glabra, Florida, in 1916, Gainesville, March 14 (20737), March 15 (20768, type of *Peridermium minutum*), March 20 (20801); in 1918, March 13 (25126), March 28 (25223), May 6 (29118); in 1919, February 24 (32103) and March 12 (32230).

P. taeda, Florida, in 1915, Brookville, March 12 (17439); in 1916, March 17 (20782); in 1919, March 2 (32165), March 11 (32229).

II and III. On *Adelia:*

A. ligustrina, Florida, in 1918, Gainesville, May 6 (25298, type of *Coleosporium minutum*); in 1919, May 14 (32363, 32862); Brooksville (32395); District of Columbia, in 1918, Washington, June 20 (29194).

COLEOSPORIUM ELEPHANTOPODIS

The successful inoculation of *Elephantopus* with *Peridermium carneum* Am. Auct. was first reported in 1917 (8), indicating the possible identity of *Coleosporium elephantopodis* (Schw.) Thüm. with *Coleosporium carneum* (Bosc) Jackson (*C. vernoniae* B. & C.). A careful study of these two species, however, has established the fact that they are not identical (10). The two are distinct in their host adaptation, in addition to slight differences in morphology. Even if these two species are not considered separate and distinct, they must at least be considered races of the same species. The writers choose to treat them as separate species, for reasons which follow:

Of 22 sets of inoculations made with *Peridermium carneum* in 1914, 8 infected plants of species of both *Elephantopus* and *Vernonia,* and 14 infected only those of *Vernonia.* Of 44 sets of inoculations made in 1915, 3 infected plants of species of both genera, 4 only those of *Elephantopus* and 37 only those of *Vernonia.* Of 28 sets of inoculations in 1916, 8 infected plants of species of both genera, 8 only those of *Elephantopus,* and 12 only those of *Vernonia.* In 1916 an effort, partially successful, was made to separate collections of *Peridermium carneum* by macroscopic characters into two lots, the one belonging to *Coleosporium elephantopodis,* the other to *Coleosporium carneum.* Later efforts have been quite successful.

From 1916 to 1919, 31 sets of inoculations have been made from aecial material adjudged to be the aecia of *Coleosporium carneum;* of these 24 infected only plants of species of *Vernonia,* 7 infected those of both *Vernonia* and *Elephantopus,* and none of

them, *Elephantopus* only. During the same period, 23 sets of inoculations have been made from aecial material adjudged to be the aecia of *Coleosporium elephantopodis;* of these, 17 infected only plants of species of *Elephantopus,* 6 infected plants of species of both *Elephantopus* and *Vernonia,* while in no case were those of *Vernonia* alone infected.

From 1916 to 1919, 10 sets of inoculations were made with aecial material grown in the greenhouse at Washington, D. C., by inoculating pines in incubation chambers with sporidia from the fresh telia of *Coleosporium elephantopodis.* In all of these sets, plants of species of *Elephantopus* were infected, those of *Vernonia* in each set remaining free from infection. During the same period, aecial material of *Coleosporium carneum* grown in the same manner was used in 4 sets of experiments with the result that only plants of species of *Vernonia* were infected, those of *Elephantopus* in each set remaining free from infection.

From 1914 to 1919, 7 sets of inoculations were made with the urediniospores of *Coleosporium elephantopodis* resulting in the infection only of plants of species of *Elephantopus,* those of *Vernonia* in each set remaining free from infection. During the same period 8 sets of inoculations were made with the urediniospores of *Coleosporium carneum,* resulting in the infection only of plants of species of *Vernonia,* those of *Elephantopus* in each set remaining free from infection. From the foregoing results we conclude that these two Coleosporiums are distinct species physiologically.

The *Peridermium* which infects plants of species of *Elephantopus* is very much less common than the one infecting plants of species of *Vernonia.* The former fungus has fewer, smaller, and lighter colored pycnia, which are ordinarily in shorter rows than those of the latter. The aecia of the former are more commonly somewhat triangular in side view, and usually slightly smaller. The peridial cells of the former usually do not overlap, while those of the latter are commonly overlapping. The aeciospores and urediniospores of the former are slightly smaller and more commonly globose and their cell walls are usually nearly uniform in thickness, while those of the latter are frequently distinctly thickened at the apex.

Upon the basis of the above physiological and morphological differences, the aecial form of *Coleosporium elephantopodis* (Schw.) Thüm. is designated **Peridermium elephantopodis** (Schw.) Hedgc. and Hahn, comb. nov. to distinguish it from other species of the form genus *Peridermium*, with the following description:

Pycnia amphigenous, solitary to several in one or two rows on chlorotic spots more commonly on the inner sides of the needles, dehiscent by a longitudinal slit, capucine-buff to orange-buff when immature, cadmium-orange to orange when sporulating, amber-brown to antique-brown at the time aecia are formed, 0.35–0.64 mm. wide, 0.36–1.06 mm. long, 0.08–0.2 mm. high, averaging 0.42 by 0.75 by 0.12 mm.; pycnospores, ovoid to ellipsoid 2–4 by 4–6 μ, averaging 2.3 by 4.1 μ.

Aecia amphigenous, solitary to few in one or two short rows, more commonly on the inner sides of the needles, flattened laterally, irregularly triangular to rectangular in side view, 0.3–0.9 mm. wide, 1.1–7.9 mm. long, 1.0–3.6 mm. high, averaging 0.7 by 3.5, by 2.3 mm.; peridia often vertically striated, orange-pink when fresh, rupturing longitudinally at the apex with irregularly notched edges; peridial cells in one layer, slightly or not overlapping, rectangular in cross section 20–40 by 32–72 μ, averaging 32 by 47 μ, with thick walls, 6–12 μ in diameter, averaging 8.5 μ, walls commonly verrucose, the inner with thickly set papillae 1–2 μ in diameter, 3–6 μ long, averaging 1.5 by 4.3 μ, aeciospores globoid to obovoid, or ellipsoid, capucine-orange in mass 14–24 by 20–32 μ, averaging 19 by 26 μ, with walls slightly or not at all thickened at the apex, 3–6 μ thick, averaging 4.2 μ, the outer surface closely verrucose with tubercles 1–2 μ in diameter, 2–4 μ long, averaging 1.4 by 2.6 μ.

The foregoing description is based on aecia from *Pinus caribaea* (20818) grown under controlled conditions in the greenhouse at Washington, D. C., from inoculations with sporidia from the telia of *Coleosporium elephantopodis* from *Elephantopus carolinianus*.

Coleosporium elephantopodis (Schw.) Thüm. has been found in the United States as follows, the data being taken from collections made by members of this office, chiefly by the senior writer.

O and I. On *Pinus:*

P. canariensis; District of Columbia.*[5]

P. caribaea; District of Columbia* and Florida.

P. contorta; District of Columbia.*

P. coulteri; District of Columbia.*

P. echinata; Alabama, District of Columbia* and Georgia.

P. mayriana; District of Columbia.*

P. palustris; Alabama, District of Columbia,* Florida, Mississippi, North Carolina and South Carolina.

P. radiata; District of Columbia.*

P. rigida; District of Columbia and North Carolina.

P. serotina; Florida.

P. taeda; Alabama, District of Columbia,* Florida, Georgia, Mississippi, North Carolina, South Carolina and Texas.

II and III. On *Elephantopus:*

E. carolinianus; Alabama, Arkansas, District of Columbia,* Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Virginia, and Texas.

E. elatus; District of Columbia,* Georgia and Mississippi.

E. nudatus; Florida.

E. tomentosus; District of Columbia,* Florida, Mississippi, North Carolina, South Carolina and Tennessee.

COLEOSPORIUM CARNEUM

Peridermium carneum (Bosc) Seym. & Earle, the aecial form of *Coleosporium carneum* (Bosc) Jackson (9) was first described and illustrated by Bosc (5) in 1811 from a specimen on *Pinus palustris* from South Carolina. The description is meager and might apply to most any species of *Peridermium* on the needles of pine from South Carolina. The illustration, however, which Bosc gives is that of the form of *Peridermium carneum* found to infect species of *Vernonia* in our inoculations. Arthur in 1910 (2) first proved that *Peridermium carneum* belongs to *Coleosporium carneum* on species of *Vernonia.*

In order to set apart the aecial form of *Coleosporium carneum* from that of *Coleosporium elephantopodis,* the following descrip-

[5] Hosts or collections obtained from artificial inoculations in the greenhouse at Washington, D. C., are indicated here and later by an asterisk (*).

tion is given of *Peridermium carneum* made from aecia on *Pinus caribaea* (25282) grown under similar and controlled conditions in the greenhouse at Washington, D. C., from inoculations with sporidia from the telia of *Coleosporium vernoniae* from *Vernonia noveboracensis*.

Pycnia amphigenous, solitary to several, in a single extended row on each side of the needles chiefly the inner, on distinctly yellowed-chlorotic spots, salmon-orange to orange-chrome before and at maturity, orange-rufous to auburn or chestnut after maturity, 0.1–0.2 mm. wide, 0.6–1.4 mm. long, 0.4–1 mm. high, averaging 0.13 by 0.57 by 0.92 mm.

Aecia amphigenous, solitary to several, extended in a single row chiefly on the inner sides of the needles, flattened laterally, usually irregularly rectangular or truncate, occasionally irregularly triangular in side view, 0.4–0.9 mm. wide, 1.5–8.4 mm. long, 1.8–4 mm. high, averaging 0.7 by 3.3 by 2.6 mm.; peridia sometimes vertically striate, rupturing longitudinally at the apex with irregular edges; peridial cells irregularly rhomboidal in cross section, usually considerably overlapping, 20–38 by 33–45 μ, averaging 27 by 29 μ, with thick walls 4–8 μ in diameter, averaging 5.2 μ, the inner walls, sometimes the outer, verrucose with dense papillae 1–2 by 3–5 μ, averaging 1.7 by 3.8 μ; aeciospores, obovoid to ellipsoid, 16–25 by 25–38 μ, averaging 21.8–33.2 μ, with walls often thickened at the apex, walls 3–9 μ thick, averaging 6 μ, the outer surface verrucose with tubercles 2–3 by 2–7 μ, averaging 1.9 by 3.9 μ.

Coleosporium carneum (Bosc) Jackson has been found in the United States as follows, the data being taken from collections made by members of this office, chiefly by the senior writer:

O and I. On *Pinus:*

P. caribaea; District of Columbia,* Florida.

P. clausa; Florida.

P. coulteri; District of Columbia.*

P. echinata; Alabama, Arkansas, District of Columbia,* Florida, Georgia, North Carolina, South Carolina, Tennessee, Texas and Virginia.

P. glabra; Florida.

P. mayriana; District of Columbia.*

P. nigra autriaca; Ohio.

P. nigra laricio; Ohio.

P. palustris; Alabama, District of Columbia,* Florida, Georgia, Louisiana, North Carolina and South Carolina.

P. ponderosa (*P. scopulorum*); District of Columbia, Ohio.

P. rigida; Connecticut, District of Columbia, Maryland, North Carolina, Ohio, Pennsylvania, Virginia and West Virginia.

P. sabiniana; District of Columbia.*

P. serotina; District of Columbia,* Florida, Georgia and South Carolina.

P. taeda; Alabama, Arkansas, District of Columbia,* Florida, Georgia, Mississippi, New Jersey, North Carolina, South Carolina and Virginia.

II and III. On *Vernonia:*

V. angustifolia; Florida.

V. baldwinii; Arkansas, District of Columbia,* Mississippi and Texas.

V. blodgettii; District of Columbia,* Florida, North Carolina and South Carolina.

V. drummondi; Arkansas and Mississippi.

V. flaccidifolia; Alabama, District of Columbia,* Florida, Georgia and South Carolina.

V. gigantea; Georgia, Mississippi, South Carolina and Tennessee.

V. glauca; District of Columbia,* Louisiana and Maryland.

V. interior; Arkansas, District of Columbia* and Texas.

V. maxima; Alabama, Georgia, Louisiana, Ohio and Tennessee.

V. noveboracensis; Alabama, Connecticut, District of Columbia,* Georgia, Maryland, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia.

V. oligantha; District of Columbia,* Florida and Louisiana.

V. ovalifolia; Alabama.

V. texana; Louisiana and Texas.

V. tomentosa; Georgia and Louisiana.

Peridermium floridanum sp. nov.

A new leaf *Peridermium* was collected on *Pinus palustris* near Ocala, Florida, March 17, 1916, but with the aecia frayed and past mature. This rust was found again on the same trees,

March 15, 1918. Hunt made inoculations March 27, 1918, with the aeciospores from the latter collection on 2 plants of *Verbesina virginica* without result. Collections of the fungus in the same locality were made from different trees February 26 and 28, 1919, but no clues as to its alternate host were secured later in the year during the season for telia. This rust approaches *Peridermium acicolum* in its gross morphology but differs in the color and arrangement of the pycnia, and in the arrangement of the aecia on the leaves. It is here named **Peridermium floridanum** Hedgc. & Hahn, with the following description:

Pycnia amphigenous, several, usually in a single row on the inner surfaces of the needles, on chlorotic spots, subcuticular, dehiscent by a longitudinal slit, tawny to russet, 0.36–0.8 mm. wide, 0.5–1.5 mm. long, 1–3 mm. high, averaging 0.52 by 1.04 by 0.15 mm.

Aecia amphigenous, on chlorotic spots, usually in a single row on the inner surfaces of the needles, 0.48–0.68 mm. wide, 0.9–3.6 mm. long, 0.76–2.16 mm. high, averaging 0.58 by 1.8 by 1.42 mm.; peridia flattened laterally, rupturing longitudinally at the apex with irregularly notched edges, peridial cells usually not overlapping in one layer, occasionally two layers at the base; ovoid to ellipsoid or rhomboid, 17–32 by 32–78 μ, averaging 22 by 53 μ, with walls 4–8 μ, averaging 5.4 μ, the outer walls thicker, walls verrucose with crowded papillae 1–2 μ in diameter, 3–6 μ long, averaging 1 by 4.4 μ aeciospores obovoid to ellipsoid, 12–20 by 22–38 μ, averaging 17 by 29 μ, with walls 1–4 μ thick, averaging 3 μ, the outer surface verrucose with short tubercles, 1–3 μ in diameter by 1–4 μ long, averaging 1.5 by 2.6 μ.

This *Peridermium* has been collected only in Florida near Ocala on *Pinus palustris* as follows: in 1916, March 17 (specimens lost); in 1918, March 15 (25137); in 1919, February 26 (32129), February 28 (32150, type of species).

PERIDERMIUM INTERMEDIUM

From 1914 to 1919, collections of *Peridermium intermedium* Am. Auct. from the needles of *Pinus echinata* were made from Alabama, Arkansas, Georgia, North Carolina, South Carolina, Tennessee and Texas. These were used in 18 sets of experiments in which there were inoculated 192 plants of species of

Aster, Chrysopsis, Coreopsis, Elephantopus, Euthamia, Helianthus, Ipomoeae, Pharbitis, Solidago, Verbesina, and *Vernonia* known to be susceptible to species of *Coleosporium.* In 9 of these experiments, plants of species of *Vernonia* only were infected; in one experiment, plants of species of both *Vrnonia* and *Elephantopus;* and in 8 experiments there was no infection. Control plants in each experiment remained free from infection.

In our inoculations with sporidia from the telia of both *Coleosporium elephantopodis* and *Coleosporium carneum* trees of *Pinus echinata* were infected the following year, bearing aecia of the species used in inoculations, proving that this species of pine is a host for both species of *Coleosporium.*

Of 54 collection of *Peridermium intermedium* Am. Auct. on *Pinus echinata* collected by members of this office in Alabama, Arkansas, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee and Texas; nearly 40 apparently belong to *Peridermium carneum* and the remainder to *Peridermium elephantopodis.*

Arthur and Kern (3) in 1906 described *Peridermium intermedium* from specimens collected on the needles of *Pinus echinata* by C. H. Demetric at Perryville, Missouri. The description of the species agrees in part with that of *Peridermium carneum* and in part with that of *Peridermium elephantopodis* as given by us earlier in this paper based on specimens on *Pinus caribaea* grown from artificial cultures at Washington, D. C. It is not wise to assign the type collection of *Peridermium intermedium* at present to either of these species, since we have never had the opportunity to section and examine aecia of the type collection. We have, however, sectioned and examined part of the exsiccati which had previously been examined and assigned to *Peridermium intermedium* either by Arthur or by Kern, which we assign as follows: Collection by H. von Schrenk, Eureka Springs, Arkansas, May 23, 1906 (1101) belongs to *Coleosporium elephantopodis;* collections in North Carolina by H. von Schrenk (1099) and C. D. Howe (20718) and R. P. Dale, Okay, Arkansas (15353) belong to *Coleosporium carneum.* There is always the possibility that any older collection may have two species inter-

mixed, and since we sectioned different aecia from those studied by Arthur and Kern, we may have examined a different species. The following species of *Peridermium* are now known to occur on *Pinus echinata*, viz.: *P. acicolum, P. carneum, P. delicatulum, P. elephantopodis, P. inconspicuum, P. ipomeae,* and *P. terebinthinaceae,* and the occurrence of more than one of these species on the same tree has often been noted by the senior writer.

DATA ON THE PERIOD OF FRUITING IN FOLIICOLOUS SPECIES OF PERIDERMIUM ON PINE

The period for fruiting among foliicolous species of *Peridermium* on pine based upon the results of a large number of observations and experiments in infections is as follows: Infections take place as soon as the telia are mature on the alternate host. This begins much earlier in Florida than farther north, since the aecia and telia both mature at least two months earlier in Florida than at Washington, D. C., and three months earlier than in the mountains of Pennsylvania and in regions farther north. Aecia are mature in Florida from February to April, and telia from the middle of May to July or even later, varying with the species. Around Washington, D. C., aecia are found from April to June and telia from July to September or later. Inoculations with telia made at Washington, D. C., in September and October produce mature pycnia in two or three months and mature aecia on the same areas adjacent to the pycnia four to five months after infection. As a rule, a second crop of either pycnia or aecia is not produced in artificial infections, but four instances of deferred fruiting, one with *Peridermium acicolum,* and three with *Peridermium carneum* have been noted, in which pycnia and aecia were formed the second year following the time of inoculation. In Florida, however, the senior writer has frequently observed both *Peridermium carneum* and *P. ipomoeae* on *Pinus palustris,* bearing a second crop of aecia on the margins of old infections which had borne aecia the previous year.

NEW HOSTS FOR SPECIES OF COLEOSPORIUM

The following aecial hosts for species of *Coleosporium* are reported in this paper for the first time on species of *Pinus:*

C. carneum on *P. mayriana.**

C. delicatulum on *P. coulteri.**

C. elephantopodis on *P. canariensis,** *P. contorta,** *coulteri,** *P. radiata** and *P. serotina.**

C. inconspicum on *P. palustris* at Styx, near Columbia, South Carolina.

C. ipomoeae on *P. serotina* from *Styx*, South Carolina.

C. solidaginis on *P. coulteri.**

C. terebinthinaceae on *P. serotina*, Clearwater, South Carolina.

Peridermium floridanum on *P. palustris*, Ocala, Florida.

The following uredinial and telial hosts for species of *Coleosporium* are now reported for the first time in the United States:

C. elephantopodis on *Elephantopus elatus*, District of Columbia, Georgia and Mississippi.

C. helianthiae on *Helianthus tomentosus* and *H. tuberosus*, Virginia.

C. ipomoeae on *Pharbitis cathartica*, Florida.

C. laciniariae on *Laciniaria elegantula*, Alabama; on *L. gracilis*, Florida; on *L. laxa*, Florida; on *L. squarrulosa*, Arkansas, Georgia, and Tennessee; on *L. tenuifolia*, Florida.

C. minutum on *Adelia ligustrina*, District of Columbia* and Florida.

C. ribicola, on *Grossularia cynosbati*, Wisconsin; on *G. innominata** and *G. reclinata*, District of Columbia.*

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NOTAE MYCOLOGICAE, SER. XXIX

Micromycetes Dakotenses et Utahenses a Doct. J. F. Brenckle Lecti et Communicati

P. A. Saccardo

A. Teleomycetae

1. Rosellinia amphisphaerioides Sacc. et Speg., Syll. **I**: 262, F. Ital. *fig. 588*

Hab. in ramis putrescentibus *Ribis floridani*, Kulm, N. D., Oct., 1916 (1205).

Asci 100 × 7–8, stip. 20–26 μ longis; sporidia 1-sticha 17–21 × 7–8, fuliginea, senio longitrosum rimosa ut in *Anthostomate taeniosporo*. Esse potest forma, a loco sub cortice relaxato, deminuta et deformata, *R. mastoideae* Sacc.

2. **Rosellinia subsimilis** Sacc., sp. nov.

Peritheciis gregariis, subglobosis, minutis, nigris, glabris, 100–180 μ diam. brevissime papillatis; ascis filiformi-paraphysatis, cylindricis, subsessilibus, 89–90 × 5.5–6, 8-sporis; sporidiis oblique monostichis e cylindraceo ellipsoideo-oblongis, saepius leviter inaequilateris, utrinque rotundatis, 12–14 × 5–6, fuligineis.

Hab. in ramis decorticates emortuis *Crataegi* sp. Whitestone Gully,[1] N. D., Nov., 1916 (1188). Affinis *R. rimincolae* differt sporidiis angustioribus subcylindraceis, etc.

3. Melanopsamma pomiformis (Pers.) Sacc., Syll. **I**: 575

Hab. in ramis putrescentibus *Corni stoloniferae*. Whitestone Gully,[1] N. D., Nov., 1916 (1185). Specimina immatura et non omnino certa.

4. Didymella eupyrene Sacc., Syll. **I**: 554

Hab. in caulibus putrescentibus *Urticae gracilis*, Ft. Douglas, Utah, Majo, 1918 (53).

[1] Whitestone Gully extends from and lies east of the U. S. Monument of "Whitestone Battlefield" in Dickey County.

5. DIDYMELLA EFFUSA (Niessl) Sacc., Syll. **I**: 552

Hab. in caule emortuo *Artemisiae biennis*, Kulm, N. D., Sept., 1914 (632). Forma ascis 60–70 × 7, sporidiis breviter fusoideis, 12–15 × 4, plasmate bipartito 1-septatis, vix constrictis.

6. MELANOMMA MEDIUM Sacc. et Speg., Syll. **II**: 104

Hab. in ramis decorticatis putrescentibus *Sambuci glaucae*, Ft. Douglas, Utah, Apr., 1918 (70).

Asci 90–100 × 14; sporidia disticha v. oblique 1-sticha, teretioblonga, utrinque rotundata, 22–25 × 7–8, 3-septata, leviter constricta, dilute brunnea.

7. TEICHOSPORA SOLITARIA Ellis, Pyr. N. Amer., p. 214, *Cucurbitaria* Ell. Syll. **II**: 321.

Hab. in trunco decorticato et intemperie indurato *Atriplicis confertifoliae*, Grantville, Utah, Apr., 1918 (32).

Valde affinis est *T. oxythele* Sacc. et Briand. Syll. **IX**: 903. Berl. *Jc. II, t. 74.*

8. PLEOSPORA SHEPHERDIAE Peck., Syll. **IX**: 876

Hab. in ramis corticatis emortuis *Shepherdiae argenteae*, Whitestone Gully, N. D., Nov., 1918 (1192).

9. HYPOXYLON EFFUSUM Nits., Syll. **I**: 379

Hab. ad ligna putrescentia, Fort Riley, Kans., Oct., 1917 (101).

Phaeotrype Sacc., gen. nov. (Etym. quasi *Diatrype phaeospora*)

Stromata pulvinata, erumpenti superficialia, nigra, ostiolis vix exantibus punctulata; perithecia pauca monosticha, substantia discolori excepta. Asci breviter stipitati, octospori, aparaphysati (?). Sporidia allantoidea, majuscula, atro-olivacea. Est omnino *Diatrype* sed vere phaeospora.

10. **Phaeotrype Brencklei** Sacc., sp. nov.

Stromatibus gregariis, subsuperficialibus, peridermii laciniis basi cinctis, depresso pulvinatis, atro-nitidulis, 0.5 × 0.7 mm.

diam., superficie levissime colliculosa et punctata; intus sordide albido, carnosulo; peritheciis 8–10 monostichis, globulosis, 0.3 mm. diam., ostiolis punctiformis, obtusis, integris; ascis fusoideis breviter stipitatis, 80–85 × 8–9, octosporis; sporodiis distichis allantoideis curvis, utrinque rotundatis; 16–17 × 3.5–4, atro-olivaceis, subnigricantibus.

Hab. in ramis corticatis emortuis *Rosae* sp., Whitestone Gully, N. Dak., Nov., 1916 (1198).

11. **Diatrype paurospora** Sacc., sp. nov.

Stromatibus gregariis, erumpenti-superficialibus, peridermo cinctis, pulvinatis, nigris, duris, fragilibus, superficie colliculosis v. rimosis, 1–2 mm. diam.; peritheciis paucis, globosis, 0.3 mm diam., substantia sorde grisea exceptis; ostiolis vix excedentibus obtusis; ascis fusoideis, apice rotundatis, 35–40 × 7, subsessilibus, aparaphysatis (?), 2–4-sporis; sporidiis allantoideis, curvulis, utrinque rotundalis, 16 × 4–5, hyalinis, vix chlorinis, tunica crassiuscula.

Hab. in ramis corticatis emortuis *Quercus utahensis* pr. Ft. Douglas, Utah, Jan., 1918 (12). Imprimis ascis tantum 2–4-sporis distinguenda species.

12. EUTYPA SCABROSA (Bull.) Fuck., Syll. **I**: 171

Hab. in ramis emortuis corticatis et decorticatis *Amelanchieris alnifoliae*, Whitestone Gully, Nov., 1916 (1199).

13. EUTYPA LEIOPLACA (Fr.) Cooke, Syll. **I**: 170

Hab. in ramis decorticatis emortuis *Amelanchieris alnifoliae*, Whitestone Gully, Nov., 1916 (1182). Socia adest forma diminuta *Calosphaeriae Principis*. Specimena *Eutypae* juvenilia et tunc dubium an potrius *Eutypam latam* spectent.

14. EUTYPELLA SARCOBATI Ellis et Ev., Syll. **XIV**: 484

Hab. in ramis corticatis *Sarcobati vermiculati*, Salt Lake pr. Grantville, Utah, Apr., 1918 (29). Superficiis ligni late mycelio atrata, hinc speciis ad *Eutypam* nutat.

15. VALSA CORNICOLA Cooke, Syll. I: 122

Hab. in ramis corticatis emortuis *Corni stoloniferae*, Whitestone Gully, N. D., Nov., 1916 (1184). Est forma minor.

16. VALSA CINCTA Fr., Syll. I: 142

Hab. in ramis corticatis *Amelanchieris?*, Whitestone Gully, Nov., 1916 (1183a).

17. VALSA LEUCOSTOMA (Pers.) Fr., Syll. I: 139

Hab. in ramis corticatis *Pruni melanocarpi*, Ft. Douglas, Utah, Jul., 1918 (85). Specimina non bene evoluta.

18. **Chorostate utahensis** Sacc., sp. nov.

Stromatibus erumpentibus, prominulis pulvinatis, 1.5 mm. diam., nigricantibus; perithecis numerosis, monostichis, 0.3 mm. diam., globosis, ostiolis punctiformibus, vix extantibus; ascis cylindraceis apice rotundatis, ibique non v. vix lumine bifoveolatis, breviter stipitatis, 55–60 × 7.3–8, aparaphysatis, octosporis; sporidiis oblique monostichis, oblongo-clavatis, curvatis, 12–14 × 3–6, eguttulatis, hyalinis, constricto-1-septatis.

Hab. in ramis corticatis emortuis *Quercus utahensis*, Ft. Douglas, Utah, Majo, 1918 (94). Affinis *C. teiphaemae*, differt sporidiis curvis, loculo super crassiore rotundato, ascis angustioribus, ostiolis abbreviatis.

19. **Diaporthe (Euporthe) Brenckleana** Sacc., sp. nov.

Perithecis laxe gregariis, ligno immutato sed linea stromatica percurso immersis, globosis, 350–500 μ diam., contextu minute celluloso atro-olivaceo; ostiolis erumpentibus tereti-conicis parum extantibus; ascis fusoideis, apice rotundatis, 45–55 × 8–9, aparephysatis, octosporis; sporidiis oblique 1-stichis, cylindraceo-fusoideis, utrinque rotundatis, 14 × 3.6, inaequaliter 4-guttulatis, hyalinis, leviter constrictis.

Hab. in ramis corticatis, interdum superficie atratis, *Corni stoloniferae*, Whitestone Gully, N. D., Nov., 1916 (1186). A *D. crassicoli* ostiolo omino diverso, etc. secedit.

20. FENESTELLA MINOR Tul., Syll. **II**: 326

Hab. in ramis corticatis emortuis *Corni stoloniferae*, Whitestone Gully, N. D., Nov., 1916 (1194). Asci 100–120 × 10–12, p. spor. 80–85 μ longa, plerumque 4-spori; sporidia 6–10-septato-muralia, 25–30 × 9–11, fuliginea; stromata valsea.

21. **Lachnum crystalligerum** Sacc., sp. nov. (mox endenda)

Hab. in ramis corticatis emortuis *Rubi parviflori*, Ft. Douglas, Utah, Jul., 1918 (81). Specimina non omnino matura.

22. PYRENOPEZIZA RUBI (Fr.) Rehm., Syll. **VIII**: 361

Hab. in ramis emortuis *Rubi strigosi*, Kulm, N. D., Sept., 1916 (1190).

23. ORBILIA VINOSA (A. et S.) P. Karst., Syll. **VIII**: 622

Hab. in lignis putridis pr. Anselm, N. D., Aug., 1916 (1072).

24. CENANGIUM FURFURACEUM (Roth.) De Not., Syll. **VIII**: 565

Hab. in ramis corticatis emortuis *Ceanothi velutini*, Ft. Douglas, Utah, Apr., 1918 (39). Probabiliter haec species, sed specimina imperfecta et tunc paullulum dubia.

25. **Patinella Brenckleana** Sacc., sp. nov.

Ascomatibus gregariis, subsuperficialibus, scutellatis, applanatis, 0.7–1 mm. diam., nigris, glabris, margine rectiusculo, acuto, disco plano intus flavido, epithecio vero grumoso, atro-fulvo; ascis tereti-clavatis, apice rotundatis, deorsum sensim tenuato-stipitatis, 70 × 11–12, octosporis; sporidis distichis, fusoideis, saepe leniter curvis, utrinque obtusatis, dilutissime flavidis, farctis; paraphysibus filiformibus, hyalinis.

Hab. in cortice *Amelanchieris alnifoliae*, Whitestone Gully, N. D., Nov., 1916 (1196). Affinis *P. inquinanti* a qua differt ascomate 1 mm. lato, disco plano, sporidiis paullo minoribus, paraphysibus aequalibus.

B. DEUTEROMYCETAE

26. SPHAERONAEMA POLYMORPHUM Auersw., Syll. **III**: 185

Hab. in ramis corticatis *Pruni melanocarpae,* Ft. Douglas, Utah, Nov., 1917 (4). Dicitur status pycnid. *Cenangellae vernicosae* (Fuck.) Sacc.

27. DIPLODIA ABROTANI Fuck., Syll. Syll. **III**: 369

Hab. in caulibus emortuis *Artemisiae abrotani,* cultae, Kulm, N. D., Jan., 1917 (1207). Sporulae ovato-ellipsoideae, 20–24 × 11, diu continuae (ut *Sphaeropsis*) denique obsolete 1-septatae, sporophora interdum in pseudoparaphyses 20–30 × 1.5–2 hyalinas abeunt.

28. **Septoria Lunelliana** Sacc., sp. nov.

Pycnidiis gregariis globoso-depressis, epidermide initio velatis, 180 μ diam. subastomis, dein late dehiscentibus et collabescentibus, extus nigricantibus; contextu fulvo-brunneo, celluloso; sporulis filiformibus, rectis v. curvulis, utrinque acutulis, 65–75 × 2.3–2.5, hyalinis, obsolete-3-septatis, guttulatisque.

Hab. in foliis languidis expallentibus *Caricis atrostachyae* pr. Leeds, N. D., Jul., 1915 (J. Lunell, n. 1206). A *Septoriis* caricolis praecipue pycnidiis contextu fulvescentibus, collabescebtibus, sporulis aequalibus, obsolete 3-septatis dignoscitur.

29. **Melanconium botryosum** Sacc., sp. nov.

Acervulis erumpentibus, gregariis, nigris, peridermio laciniato cinctis, ob conidia expulsa et compacta superficie colliculoso-botryosis (sphaeriae-formibus); conidiis copiosissimis, globosis, levibus, 7–8 μ diam., ochraceo-fuligineis; conidiophoris papilliformibus, exiguis ex hypostromate celluloso, ochraeo-fusco orientibus.

Hab. in ramis corticatis emortuis *Pruni melanocarpae,* Ft. Douglas, Utah, Nov., 1917 (3). Typus singularis et vix *Melanconio* proximus, probibiliter gen. nov.

30. **Steganosporium utahense** Sacc., sp. nov.

Acervulis gregariis, subcutaneo-erumpentibus, sed non praeminentibus, 1 mm. diam., primo peridermio bullato tectis, dein ab

ejus laciniis pallidis cinctic, nigricantibus, subceraceis; conidiis polymorphis e globoso-angulosis, v. triangulis, v. gibbis, 24–31 μ diam., ex cellulis 3–10, botryoideo-conjunctis formatis, rufo-fuligineis; conidiophoris paliformibus saepe 1-septatis, subhyalinis, 28 × 8–9, ex hypostromate crasso distincte celluloso rufo-fusco oriundis.

Hab. in ramulis corticatis emortuis *Chrysothamni nauseosi*, Ft. Douglas, Utah, Apr., 1918 (27). Affine *S. heterospermo* Vesterg sed acervulis initio epidermide albida pustulata tectis, dein cinctis, conidiis non foedantibus, conidiophoris distinctis paliformibus, etc. dignoscitur.

31. DENDRYPHIUM NODULOSUM Sacc., Syll. **IV**: 490.

Hab. in caulibus emortuis putridis *Urticae gracilis*, Nyland's Grove, Lamoure County, N. D. (1181). Probabiliter *Helminthosporium interseminatum* B. et Br. vix differt.

32. EPOCHNIUM ISTHMOPHORUM Sacc., sp. nov. (mox endenda)

Hab. in caulibus emortuis *Chrysothamni nauseosi*, Ft. Douglas, Utah, Apr., 1918 (34). Genus *Epochnium* non tantum ad *Diplococcium* nutat sed et forte propius ad *Bisporam*. Conidia isthmo saepius connexa, usque ad 20–24 × 11–12.

33. CYLINDROCOLLA URTICAE (Pers.) Bon., Syll. **IV**: 674.

Hab. in caulibus *Urticae* emortuis, Ft. Douglas, Utah, Majo, 1918 (54).

VIA LUCA BELLUDI, 15,
PADOVA, ITALY.

MONOGRAPH OF THE CORYNELIACEAE

HARRY MORTON FITZPATRICK

(WITH PLATES 12–18, AND TABLE I)

The Coryneliaceae have not been critically investigated, and a monograph of the species of the world has never been prepared. Since the majority of the species occur only in tropical or subtropical regions they have been collected only occasionally. Consequently few even of the larger herbaria contain more than a meager representation of them. The present paper is based largely on material obtained through correspondence with students of mycology in many parts of the world. The investigation was begun in the summer of 1917 at the New York Botanical Garden when the specimens in the herbarium there were examined. Subsequently considerable additional material has been obtained from other American herbaria, and from many foreign sources. Marked good fortune has been experienced in obtaining type and other authentic specimens for study. The original material of almost every species has been examined. More than 130 specimens have been studied during the progress of the investigation, and the herbarium of the writer contains in excess of 80 numbers. Many institutions and individuals have cooperated in making available their herbarium and library facilities.

The writer wishes especially to acknowledge his obligation to Doctor W. A. Murrill, Doctor F. J. Seaver, and Doctor J. H. Barnhart of the New York Botanical Garden for their uniform courtesy and spirit of cooperation during his stay there. He is particularly indebted also to Professor W. G. Farlow, and Professor R. Thaxter who made available to him all the material in the herbarium at Harvard University. An excellent collection of twenty specimens from the herbarium of the Union Department of Agriculture at Pretoria, South Africa, was received from Miss Ethel M. Doidge. Additional interesting South African material was sent by Professor P. van der Bijl from the Natal

herbarium at Durban. Professor L. Romell mailed for examination seventeen specimens representing all the collections of Coryneliaceae in the herbarium of H. Rehm at Stockholm. He also forwarded from the herbarium of Sydow type material of *Corynelia carpophila* Syd., and *C. clavata* form *macrospora* Syd., and sent from the herbarium of the Royal Museum at Stockholm several valuable specimens including a portion of the original material of *C. oreophila* (Spegazzini) Starbäck. Mrs. Flora W. Patterson and Miss Vera K. Charles have made available all the material of the Coryneliaceae in the herbarium of the Bureau of Plant Industry at Washington, D. C., and Doctor Charles Fairman has loaned for examination all the material in his herbarium at Lyndonville, N. Y. The writer is also indebted to Professor L. Mangin, curator in the Museum d' Histoire Naturelle at Paris for type material of *Coryneliella consimilis* Hariot & Karsten; to Professor N. Patouillard of Neuilly-sur-Seine for type material of *Capnodium fructicolum* Patouillard; to Doctor A. D. Cotton of the Royal Botanic Gardens at Kew for type material of *Capnodium maximum* Berkeley & Curtis, *Sphaeronema subcorticale* Cooke & Ellis, and *Corynelia nipponensis* n. sp.; to Professor Carlos Spegazzini for authentic material of *Alboffia oreophila* Spegazzini; to Mr. Elam Bartholomew of Stockton, Kansas, for type material of *Corynelia brasiliensis* n. sp.; to Professor F. L. Stevens of Illinois University for type material of *C. clavata* var. *portoricensis* Stevens; to Professor S. F. Ashby, Microbiologist at Kingston, Jamaica, for type material of *C. jamaicensis* n. sp., to Doctor H. D. House of Albany, New York, for type material of *Caliciopsis pinea* Peck, to Professor O. Juel of Upsala, Sweden, for information concerning the type material of *Corynelia uberata* Fries and to Miss E. M. Wakefield of the Royal Botanic Gardens at Kew for information concerning the type material of *Corynelia tripos* Cooke and a specimen labelled *Mucor clavatus* in the herbarium of Linnaeus. Excellent material of various species has also been received from Professor G. Yamada, Morioka, Japan; Professor Elmer D. Merrill, Manila, Philippine Islands; Professor F. J. F. Shaw, Pusa, India; Mr. John A. Stevenson, Rio Piedras, Porto Rico; Professor Otto A. Reinking,

Los Banõs, Philippine Islands; Mr. Edwin B. Copeland, Chico, California; Professor H. S. Jackson, Purdue University; Doctor E. W. Olive, Brooklyn Botanic Garden; and Professor H. H. Whetzel, Cornell University.

Through the courtesy of Mr. Percy Wilson, the writer was allowed to examine all of the mounted specimens of *Podocarpus* in the phanerogamic herbarium of the New York Botanical Garden, and more than a dozen specimens of *Corynelia* which had been accidentally collected were found there. Professor A. J. Eames of Cornell University examined in like manner all of the material of *Podocarpus* in the Gray herbarium at Harvard University and obtained several valuable specimens. A similar search was made by Doctor S. M. Zeller in the herbarium of the Missouri Botanical Garden, and by Miss Vera K. Charles in the herbarium of the National Museum at Washington, D. C. A considerable number of valuable specimens were obtained in this way and the writer wishes to express his appreciation of the aid given him in this search. All the possibilities known to the writer for obtaining material of the group for study have been exhausted, and he feels that no additional material, the examination of which would contribute materially to the completeness of this paper, is available to him. Nevertheless it is probable that in those tropical countries in which fungi have been little studied, other species of the group will be discovered. It is hoped that the publication of this paper will stimulate the search for these forms. Finally the writer wishes to express his indebtedness to Professor H. H. Whetzel for the suggestion that the monograph be prepared, and for aid and encouragement given during the progress of the investigation. Thanks are also due to Mr. W. R. Fisher for the care taken in the preparation of the photographs which illustrate the paper, and to Mr. C. E. Chardon who, under the writer's immediate direction, prepared the plate of drawings and the phyllogenetic chart which occurs in the text.

SYSTEMATIC RELATIONS OF THE CORYNELIACEAE

The family Coryneliaceae was erected in 1891 by Saccardo (**45**) to embrace the two genera Corynelia and Tripospora. As orig-

inally constituted it contained only two species, *Corynelia uberata* Fries and *Tripospora Cookei* (Cooke) Saccardo. The family diagnosis reads: "*Perithecia coriacea, atra, lageniformia, ostiolo elongato, apice perforato, dein late infundibuliformiter expanso.*" In 1895 Saccardo (**45**) included in the family the genus *Coryneliella* represented by the single species *C. consimilis* Hariot & Karsten.

Lindau (**28**) in his treatment of the Sphaeriales includes in the Coryneliaceae the three genera *Corynelia, Coryneliella,* and *Tripospora,* and states that each is monotypic. Subsequently, Saccardo (**45**) has recorded the discovery and description of several additional species of *Corynelia.* Lindau regards the family as closely related to the Cucurbitariaceae, and emphasizes the fact that the two are alike in having the perithecia seated on a stroma. In his discussion of the Coryneliaceae, he states that the perithecium is flask-shaped with a long neck dilated at the apex and provided with a broad funnel-shaped mouth. The flask-shaped character of the perithecium is used by him to separate the Coryneliaceae from the Cucurbitariaceae, the perithecium in the latter family being more or less definitely globose.

It will be noted that both Saccardo and Lindau describe the perithecium as ostiolate, and as typical, therefore, of the Sphaeriales. Their statements in this connection are evidently based largely on the observations of Winter (**55**) on *Corynelia uberata* and *Tripospora tripos.* Cooke (**8**), however, from the examination of material of *Corynelia uberata* was led to place the genus *Corynelia* in the Perisporiaceae between *Capnodium* and *Antennaria,* and states that the perithecium is "wholly closed, hence without a mouth and irregularly split."

The writer's own observations show that the Coryneliaceae lack the typical ostiolum present in the Sphaeriales, and he sees no reason for regarding the group as closely related to the Cucurbitariaceae. The perithecium on the other hand cannot be correctly described as lacking a mouth or as irregularly split. In all the known species of the perithecium in the young condition is wholly closed, but at maturity it ruptures at the apex in a definite manner. In certain of the species, which the writer believes to

represent the more primitive condition, the perithecium ruptures at maturity in such a manner that the apex becomes fimbriate-lacerate, the hyphal elements pulling apart and recurving to form a fringe about a funnel-shaped opening. In other species, which evidently represent a more specialized and higher type of development, the perithecium is definitely and deeply cleft at the apex. In some of these cases a single cleft is formed; in others, the apex of the perithecium splits in a radial manner, three or more definite lobes resulting. In *Corynelia tropica* a single deep cleft is formed accompanied by a more or less evident fimbriate-laceration of the two lobes. This species possesses, therefore, an intermediate type of dehiscence. Since in several species of *Corynelia* the line of dehiscence follows wholly evident and prominent grooves which exist in the perithecium, even in the young condition, the type of dehiscence can certainly not be termed indefinite. At the same time the term ostiolum has not been applied to an opening as large as that which results in this case where in some species the whole interior of the perithecium is exposed. It might be assumed that an approach to this condition is found in the Sphaeriales in the Lophiostomataceae where an elongated slit-like mouth is termed the ostiolum. In this case, however, the opening is absolutely definite and small and never enlarges to expose the interior of the perithecium as in some of the Coryneliaceae.

Two species, *Corynelia fructicola* and *Sorica maxima*, embraced in this monograph were originally described as members of the genus *Capnodium* of the Perisporiaceae. They differ from other species of this genus in their possession of a definite erumpent stroma and in the absence of aerial mycelium. Moreover the characters of their perithecia, asci, and spores indicate that they are closely related to the species embraced in the genus *Corynelia*. Nevertheless it is evident that not only the genus *Capnodium* but also certain other genera of the Perisporiaceae possess many characters in common with the Coryneliaceae, and it has become increasingly evident that the two groups are closely related. The species of *Caliciopsis* have not been previously considered as members either of the Perisporiaceae or the Coryneliaceae. They

are, however, certainly closely related to *Sorica maxima*, and this species in turn possesses so many characters in common with *Corynelia fructicola* that it cannot easily be excluded from the Coryneliaceae. The genera *Sorica* and *Caliciopsis* may perhaps be regarded as transition forms between the Perisporiaceae and the Coryneliaceae, but their possession of an erumpent stroma and the definite apical dehiscence of the perithecium makes necessary their inclusion in the Coryneliaceae as delimited in this monograph. The characters of their asci and spores indicate, moreover, a close relationship with the species of *Corynelia*.

The Perisporiales are separated from the Sphaeriales chiefly on the basis of the difference in the method of dehiscence of the perithecium. Lindau (**28**) states that in the Sphaeriales the perithecium is provided with a definite ostiolum, while in the Perisporiales there is developed either a more or less globose, cleistocarp perithecium completely inclosing the asci and at maturity irregularly dehiscent, usually through disintegration (Erysiphaceae, Perisporiaceae), or a shield-shaped, imperfectly developed perithecium in some species dehiscent at the center by a circular pore (Microthyriaceae). In some species of the Perisporiaceae, however, the perithecium dehisces more or less definitely at the apex either by a small number of radial splits forming prominent lobes or by the method of fimbriate-laceration characteristic of *Caliciopsis*, *Sorica*, *Tripospora*, and *Corynelia fructicola*. On the other hand a few species of the Chaetomiaceae and Sordariaceae of the Sphaeriales fail to develop the usual ostiolum and dehisce irregularly.

The most constant characteristic of the Perisporiales is the production of superficial perithecia on aerial mycelium. These fungi cannot be said to differ essentially in this respect, however, from the Chaetomiaceae or other lower groups of the Sphaeriales. Moreover in the Perisporiales the existence of such forms as *Oidiopsis taurica* (Salmon **46**) shows that even in this group the mycelium is not necessarily always superficial. A consideration of all these facts concerning the method of dehiscence of the perithecium, combined with a comparative study of the general morphology of the fungi embraced in the Perisporiales raises the

question whether or not these forms really comprise a natural order. On account of the tropical distribution of many of the species our knowledge of the Perisporiaceae and Microthyriaceae is recognized to be very imperfect, and it may be safely assumed that further study will result in pronounced changes in their classification. It is possible that many of the species embraced in the Perisporiaceae are more closely related to the Sordariaceae and other lower Sphaeriales than they are to the Microthyriaceae, many of which in turn might well be relegated to the Phacidiales. The genus *Diplocarpon*, as pointed out by Wolf (**56**) may indeed be regarded as furnishing a transition to this group.

The Sphaeriales, on account of their possession of a definite ostiolum may be assumed to be more highly developed than the Perisporiales. Still it is probable that they had their origin in fungi similar to the Perisporiaceae, and perhaps developed from these along several different lines.

The Coryneliaceae as constituted in the present paper cannot be placed with entire satisfaction either in the Sphaeriales or in the Perisporiales as delimited by Lindau and other authors. The absence of superficial mycelium and the development of the perithecia on an erumpent stroma render them unlike the Perisporiales, while the absence of a true ostiolum excludes them from the Sphaeriales. The problem is further complicated by the existence in the single genus *Corynelia* of two distinct types of dehiscence. In this connection it should be noted that although the more primitive of the two sorts of dehiscence has its counterpart in certain of the Perisporiaceae, the other and clearly more specialized method is wholly unlike anything hitherto described for any of the pyrenomycetes. A consideration of all the available data in the light of the questions involved makes it evident that the grounds for the inclusion of the Coryneliaceae among the higher Sphaeriales in the neighborhood of the Cucurbitariaceae are wholly untenable. These fungi are clearly of an essentially different and more primitive type. They are probably more closely related to the Perisporiaceae than to any other group, and their development of a unique type of dehiscence indicates an ancient origin.

The incorporation of the Coryneliaceae in the Perisporiales will necessitate some widening of the limits of this order, but this is probably at present the most logical disposition of the group. Since all the species lack aerial mycelium and bear their perithecia and pycnidia on an erumpent stroma, they differ essentially from the Perisporiaceae and clearly comprise a separate family. When the forms included by Lindau in the Perisporiaceae are more critically studied and the method of dehiscence in all of them is clearly understood, it is probable that the line of separation between the two families can be drawn with greater definiteness than at present.

INTER-RELATIONSHIPS OF THE SPECIES WITHIN THE FAMILY

A comparative study of the various species in the family has led to some interesting conclusions concerning the phyllogeny of the group as a whole. It has also made clear the general line of development of the more highly specialized species from the lower more generalized ones. The accompanying chart gives in detail the writer's conception of the evolution of these forms.

Certain characters of the ancestral stock from which the Coryneliaceae of the present arose are easy to surmise. These ancestral forms evidently resembled in many respects the fungi now included in *Capnodium*. They had acquired, however, a pronounced tendency toward the parasitic habit, possessed internal rather than aerial mycelium, and bore their perithecia in a cespitose cluster on a definite erumpent stroma. We may assume also that the perithecium was elongated in form, probably definitely stalked, and that dehiscence was apical and of the type termed fimbriate-lacerate. The perithecium was further characterized by the absence of paraphyses and by the production of broadly ovoidal, long-stipitate, 8-spored asci with unicellular, spherical to oval spores. The species of *Caliciopsis* regarded by the writer as the most primitive members of the group now extant, have departed from this type relatively little. Other members of the family apparently somewhat less primitive in type are *Sorica maxima*, *Tripospora tripos*, and *Corynelia fructicola*. These species have resulted from development along very different lines.

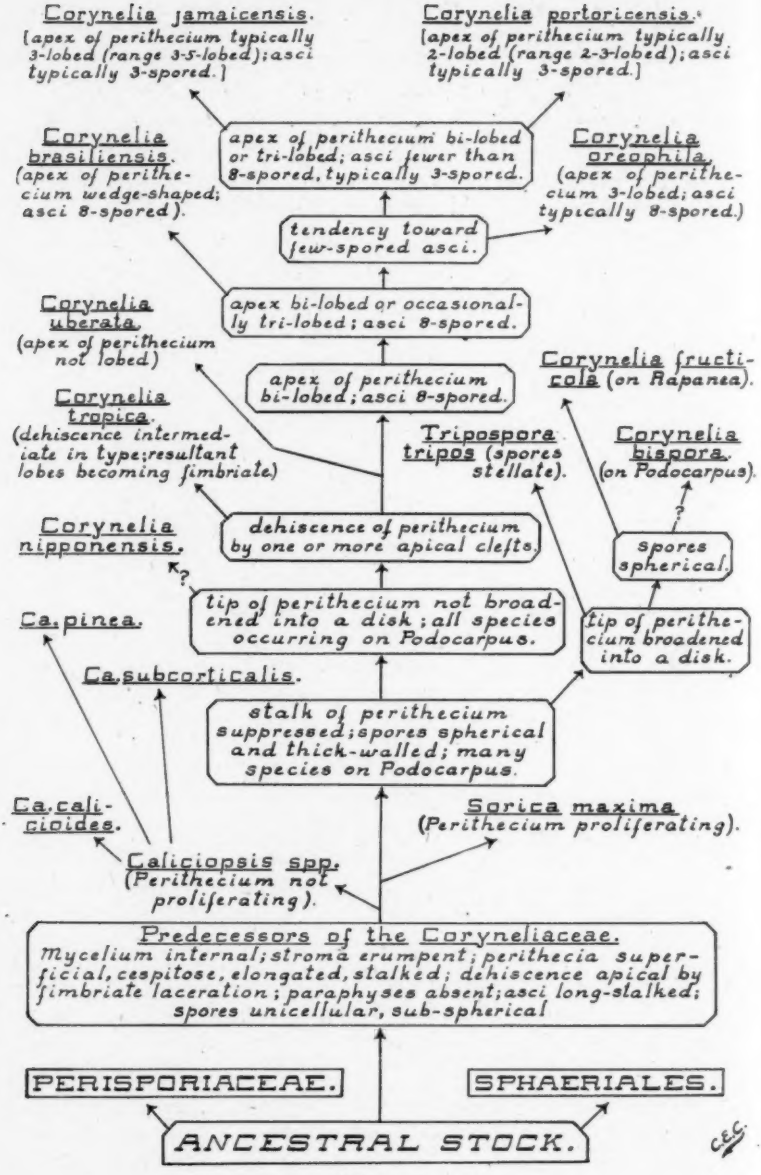

Corynelia jamaicensis. (apex of perithecium typically 3-lobed (range 3-5-lobed); asci typically 8-spored.)
Corynelia portoricensis. (apex of perithecium typically 2-lobed (range 2-3-lobed); asci typically 8-spored.)
Corynelia brasiliensis. (apex of perithecium wedge-shaped; asci 8-spored).
apex of perithecium bi-lobed or tri-lobed; asci fewer than 8-spored, typically 8-spored.
Corynelia oreophila. (apex of perithecium 3-lobed; asci typically 8-spored.)
tendency toward few-spored asci.
Corynelia uberata. (apex of perithecium not lobed)
apex bi-lobed or occasionally tri-lobed; asci 8-spored.
Corynelia fructicola (on Rapanea).
Corynelia tropica. (dehiscence intermediate in type; resultant lobes becoming fimbriate)
apex of perithecium bi-lobed; asci 8-spored.
Tripospora tripos (spores stellate).
Corynelia bispora. (on Podocarpus).
Corynelia nipponensis.
dehiscence of perithecium by one or more apical clefts.
spores spherical.
tip of perithecium not broadened into a disk; all species occurring on Podocarpus.
Ca. pinea.
tip of perithecium broadened into a disk.
Ca. subcorticalis.
stalk of perithecium suppressed; spores spherical and thick-walled; many species on Podocarpus.
Ca. calicioides.
Sorica maxima (Perithecium proliferating).
Caliciopsis spp. (Perithecium not proliferating).
Predecessors of the Coryneliaceae.
Mycelium internal; stroma erumpent; perithecia superficial, cespitose, elongated, stalked; dehiscence apical by fimbriate laceration; paraphyses absent; asci long-stalked; spores unicellular, sub-spherical
PERISPORIACEAE.
SPHAERIALES.
ANCESTRAL STOCK.

TABLE I

In *Sorica maxima* the perithecium resembles that in *Caliciopsis* but has the ability to proliferate in a remarkable manner, a new perithecium being developed at the tip of the old. In *Tripospora tripos* and *Corynelia fructicola* the perithecium dehisces as in *Caliciopsis* and *Sorica*, but the long stalk of the perithecium is absent, and in form and habit the species more closely approximate the more highly developed members of the group. These two species are remarkably similar in the general appearance of the perithecium, which is flask-shaped with a long, narrow neck dilated at the apex to form a broad, flat disc. They differ chiefly in the character of their spores. The existence of the peculiar stellate spores in *Tripospora tripos* is difficult to explain. No other species in the family shows a tendency toward the development of this stellate character, the brown, oval or spherical spores being remarkably similar throughout the group. The occurrence of *Corynelia fructicola* on *Rapanea* and the occurrence of *Tripospora tripos* on *Podocarpus* is noteworthy. Since all of the other species of *Corynelia* occur on *Podocarpus* it seems logical to conclude that the ancestral stock had become restricted to this host before the stellate spores of *Tripospora* appeared. Otherwise the occurrence of *Tripospora* on *Podocarpus* must necessarily be regarded as a coincidence.

The most primitive species in which dehiscence of the perithecium by an apical split occurs is probably *Corynelia tropica*. *Corynelia uberata* shows this type of dehiscence slightly more highly developed. In *Corynelia tropica* the apical split is accompanied by fimbriate-laceration of the resultant lobes, the transition to the more primitive condition thus being shown. Dehiscent perithecia of *C. bispora* and *C. nipponensis* have not been seen, but the probable position of these species in the phyllogeny of the group as indicated by other characters is shown in the accompanying chart. In none of these species is the apex of the perithecium lobed.

It may be safely assumed that a perithecium definitely lobed at the apex shows in this respect a more recent modification than one with the more usual rounded apex. Following the same line of reasoning we may assume that a definitely 3-lobed apex repre-

sents a more recent development than a similarly 2-lobed one. In any case these assumptions make it possible to explain very satisfactorily the inter-relationships of the four known species which clearly represent the highest type of development in the genus *Corynelia*. These species (*C. oreophila, C. brasiliensis, C. portoricensis* and *C. jamaicensis*) are restricted, as far as is known, to the Western Hemisphere, and in all of them the upper portion of the perithecium is marked on the surface by one or more prominent grooves along which dehiscence takes place. They constitute a definite group of closely related species, and it is of interest to speculate concerning the character of the parent stock from which they arose. Here as in the more primitive species of *Corynelia* the asci were doubtless 8-spored. The perithecium was usually 2-lobed at the apex but occasionally a 3-lobed individual occurred. There was also the tendency for asci to occasionally bear less than eight spores, though this phenomenon was not common or pronounced. From this parent stock along one line *C. oreophila* arose by the increasing tendency toward the occurrence of 3-lobed perithecia. This species as it exists today is characterized by 3-lobed perithecia, though an occasional 2-lobed individual shows the retention of the ancestral character. The asci like those of the parent stock are 8-spored though occasional asci contain a smaller number of spores. From the parent stock along a neighboring line *C. brasiliensis* arose by the development on the perithecium of a wedge-shaped apex. In all other respects this species is like *C. oreophila*. The occasional occurrence on the stroma among the typical perithecia of a few small, poorly developed individuals with 2-lobed and 3-lobed apices exactly like those of *C. oreophila* constitutes reversion to the ancestral condition.

Along a third line *C. portoricensis* and *C. jamaicensis* arose from the parent stock by the increasing tendency for the asci to be few-spored. In *C. portoricensis* the form of the perithecium may be assumed to have changed relatively little. The majority of the perithecia are 2-lobed at the apex; a few are 3-lobed. The asci, however, have changed pronouncedly. The tendency seen in the parent stock for the number of spores in the ascus to de-

crease has been carried here to such an extreme that the asci are typically 3- or 2-spored. Occasionally 1-spored asci occur while less commonly asci with more than three spores are found. In *C. jamaicensis* similar conditions are found in the ascus, the tendency toward a 1-spored ascus being carried slightly farther and asci containing more than three spores being rarer than in *C. portoricensis*. The perithcium in *C. jamaicensis* has however changed also, the tendency in the ancestral stock for 3-parted perithecia to occur having been intensified here until 2-lobed individuals are no longer found. Moreover there is evident the tendency for occasional 4-lobed or even 5-lobed apices to appear, the change in the perithecium thus being even more pronounced than in *C. oreophila*, the species which *C. jamaicensis* most closely resembles externally. A study of the known geographical distribution of these four species is also instructive. The two species in which the 3-spored ascus is typical have been reported only from the West Indies, while the two species with typically 8-spored asci are continental having been found only in South America and Central America. On account of the high specialization both in the ascus and in the perithecium, *C. jamaicensis* is to be regarded as representing the highest point of development in the group.

HOST RELATIONSHIPS

The writer has attempted to determine whether or not the various species of *Corynelia* have become restricted to definite species of *Podocarpus*. The amount of material available for study has, however, been insufficient to warrant definite conclusions. Nevertheless the following facts should be recorded. The writer has studied material from twenty-one different species of *Podocarpus* and in only two cases has a single species been found to serve as a host for more than one species of the Coryneliaceae. Both *Tripospora tripos* and *Corynelia uberata* have been found on *Podocarpus elongata*, while *Corynelia oreophila* and *C. tropica* occur on *P. chilina*. In both of these cases the fungi are however of relatively distant relationship. Closely related species have not been seen on the same host. Moreover

a single species frequently occurs on several species of *Podocarpus*. Four hosts have been noted for *C. oreophila*, four for *C. tropica*, and seven for *C. uberata*. Since the genus *Podocarpus* contains a very large number of species and the writer's material of the Coryneliaceae is doubtless relatively limited, the above facts may, however, be found to explain themselves on the basis of coincidence.

SYSTEMATIC ACCOUNT

CORYNELIACEAE Saccardo, Syll. Fung. 9: 1073. 1891

Corynelieae Sacc., in Berlese et Voglino, Additamenta Sylloge Fungorum, p. 193. 1886.

Fungi typically parasitic (two little-known species, *Caliciopsis subcorticalis* and *C. calicioides*, described as saprophytic); stromata formed beneath the epidermis of the host from internal mycelium, later erumpent, black, coriaceous to carbonaceous, sharply demarcated, plane to pulvinate, usually small and scattered, rarely confluent; perithecia seated on the stroma or slightly buried in it, usually cespitose, black, elongated (flask-shaped, barrel-shaped, clavate, top-shaped, etc.), sessile or stipitate; apex either rounded and undifferentiated or variously sulcate and lobed, in some cases flattened into a broad disc, never possessing a typical ostiolum, at maturity dehiscent by a definite, wide opening resulting either from the formation of one or more clefts or by fimbriate-laceration; asci broadly ovate, very long-stipitate, thin-walled, evanescent, 1–8-spored, aparaphysate; ascospores spherical to oval or in one species stellate; asexual spores, unicellular, elongated to allantoid, hyaline to slightly yellowish, borne in pycnidia which usualy accompany the perithecia on the stroma.

KEY TO GENERA

A. Ascospores spherical to oval.
  1. Perithecium definitely stalked.
    a. Perithecium not undergoing proliferation to form a second perithecium at the apex of the first.....1. *Caliciopsis.*
    b. Perithecium proliferating.....2. *Sorica.*
  2. Perithecium not definitely stalked.....4. *Corynelia.*
B. Ascospores stellate.....3. *Tripospora.*

1. CALICIOPSIS Peck, Ann. Rept. N. Y. State Mus. Nat. Hist. 33: 32. 1880

Hypsotheca Ellis and Everhart, Jour. Mycol. 1: 128. 1885.

Type species, *Caliciopsis pinea* Peck.

Stromata pulvinate, rounded to elongated, scattered or arranged in rather definite rows, occasionally confluent, formed within the host tissue but soon erumpent, bearing a cespitose cluster of perithecia and pycnidia; perithecium black, coriaceous to carbonaceous, stalked, not proliferating; the ascigerous swelling terminal to a sub-median but not basal, when sub-apical then terminated by a tapering beak, urceolate to sub-cylindrical; apex of perithecium at first closed, later a definite opening formed by fimbriate-laceration; asci ovate to clavate, long-stalked, thin-walled, evanescent, 8-spored, aparaphysate; ascospores varying from ellipsoidal or sub-fusiform to globose, crowded, smooth, brown, unicellular, thin-walled; pycnidia borne on the stroma with the perithecia, cespitose, sessile, globose to sub-globose, black, papillate, apically ostiolate; pycnospores hyaline or in mass slightly yellowish, minute, unicellular, allantoid.

This genus is very cosely related to *Sorica*. Dehiscence of the perithecium takes place in exactly the same manner in the two genera, and perithecia, pycnidia, asci, and spores are very similar in the two cases. The presence in *Sorica* of the phenomenon of perithecial proliferation is the only essential difference.

Peck (**37**) founded the genus on *C. pinea*, and states that the species is a discomycete and should be placed near *Cenangium*. He points out that, although in external appearance it resembles certain species of *Calicium*, it is wholly destitute of a thalline crust and gonidial cells, and must be regarded as one of the true fungi.

Ellis (**10**) in founding *Hypsotheca* states that the genus is clearly closely related to *Caliciopsis*, but, apparently influenced by Peck's statement that *Caliciopsis* is a discomycete, he fails to include it in North American Pyrenomycetes (Ellis **11**). He places *Hypsotheca* in the Ceratostomeae on account of the beaked nature of the perithecium, and includes three species, *H. calicioides*, *H. subcorticalis*, and *H. thujina*.

Rehm (**41**) recognizes the identity of *Hypsotheca* and *Cali-*

ciopsis, and adopts the latter name for the genus. He incorporates it in the Calicieae treating this group as a subdivision of the Patellariaceae of the true discomycetes. He states that while it is apparently true that the majority of the Calicieae possess a more or less well developed lichen thallus, in certain species this has not been demonstrated and seems to be absent. These latter species, therefore, are treated as a group of the true fungi. Seven genera, *Calicium, Caliciopsis, Coniocybe, Sphinctrina, Cyphelium, Acolium,* and *Stenocybe* are included by him in the true discomycetes. It is evident that he is in error in incorporating *Caliciopsis* among these forms. Although the stipitate character of the fruit-body furnishes a point of similarity between *Caliciopsis, Calicium, Stenocybe, Cyphelium,* and *Coniocybe,* there exist important points of difference. The fruit-body of *Caliciopsis* is very certainly a perithecium, while in at least some of the other genera described by Rehm, it is just as surely an apothecium. The examination of Rehm's figures, and of such material as has been available, leads the writer to believe that with the exception of *Caliciopsis,* the other genera included here by Rehm are as stated by him, discomycetous in character. Certainly in the light of our present knowledge there is no reason for regarding them as closely related to the Coryneliaceae.

KEY TO THE SPECIES OF CALICIOPSIS

A. Ascigerous cavity sub-apical, median or sub-median; perithecium beaked; species described as saprophytic on wood of deciduous trees.
1. Ascospores 6–10 × 3.5–5 μ; perithecium stout and short-stalked. 1. *C. calicioides* (Figs. 35, 36, 47)
2. Ascospores 4–5 × 3–4 μ; perithecium slender and long-stalked. 2. *C. subcorticalis* (Figs. 37, 38)
B. Ascigerous cavity terminal; perithecium not beaked; species occurring on conifers; ascospores 3.5–6 × 2–4 μ.....3. *C. pinea* (Figs. 33, 34, 48)

1. **Caliciopsis calicioides** (Fries) comb. nov.

? Sporocybe calicioides Fries, Syst. Mycol. **3**: 340, 342. 1832.
Hypsotheca calicioides E. & E., Jour. Mycol. **1**: 129. 1885.
Caliciopsis Ellisii Saccardo, Sylloge Fungorum, **8**: 833, 834. 1889.
Hypsotheca caliciodes (Fr.) var. *caespitosa* Ellis in MS.

TYPE: Material labeled *Hypsotheca calicioides* E. & E. in the herbarium of Ellis at the N. Y. Bot. Gard. (collected by Suksdorf in Washington, and sent to Ellis by Sprague).

(Figures 35, 36, 47)

Mycelium in the cortical tissue of poplar, apparently saprophytic; stromata 500–1700 μ in diameter, more or less circular to elongated, scattered or developing in rather definite lines, which appear as concentric circles a few millimeters apart, adjacent stromata occasionally confluent; pycnidia and perithecia borne frequently on the same stroma, cespitose; perithecium shiny to dull, when young glabrous, in age becoming definitely roughened especially over the surface of the ascigerous swelling, 1400–1800 μ long, coriaceous, becoming brittle in age or on drying, consisting of a stalk, a median or sub-median enlargement containing the ascigerous cavity and a terminal beak; the enlargement sub-cylindrical-vesiculose, 270–480 μ long and measuring in lateral diameter at the middle 200–340 μ, not observed to collapse laterally as in the other species of the genus; the stalk 100–170 μ in diameter, relatively shorter and more rigid than in the other species, somewhat broadened at the base; beak at the beginning merely a short conical continuation of the ascigerous enlargement,[1] later more elongated, rigid and straight or sometimes curved, reaching in some cases 1 mm. in length, narrower than the stalk, 75–125 μ in diameter; the apex in the beginning sharp-pointed and closed, sometimes possessing a minute umbilicus which resembles superficially an ostiolum, at maturity becoming fimbriate-lacerate, the hyphal elements spreading apart and forming a broad, reddish-brown, fuzzy fringe around a central funnel-shaped opening; asci ovate to clavate, 15–20 $\times$ 8–11 μ; spores sub-fusiform to ellipsoidal to oval, 6–10 $\times$ 3.5–5 μ (aver. 7 $\times$ 3.5 μ); pycnidia 140 μ in diam.; pycnospores 2.5–3 μ long, hyaline or in mass slightly yellowish.

Ellis (10, 11) based his published descriptions of this species chiefly on the material collected by Suksdorf in Washington on poplar. He saw also, however, the material distributed by Ravenel,[2] and regarded the two collections as identical. The writer has examined material of both of these collections and also of an additional collection in the herbarium of Ellis labeled by him *Hypsotheca calicioides* (Fr.) var. *caespitosa* n. var.

[1] A double ascigerous enlargement forked at the upper end and bearing two beaks was present in one case as an interesting abnormality.

[2] Fungi Caroliniani I: 83.

This last collection was made in 1891, but Ellis makes no reference to it in North American Pyrenomycetes or in subsequent papers. In this material the stromata are broader than in the Suksdorf collection and the perithecia of a single cluster are consequently more numerous. The cespitose habit is present in both cases though in the Suksdorf material a single perithecium may sometimes occur alone on a small stroma. It is probable that the Suksdorf material is somewhat younger, especially since the ascospores are slightly smaller and lighter colored. In the material distributed by Ravenel the perithecia seem somewhat more slender than in the Suksdorf collection. The relatively small number of collections of material available for study renders these minor differences especially noticeable and in the present state of our knowledge there seems to be no better course than to incorporate the known material under the one species.

The species differs from *C. subcorticalis* especially in its stouter, more rigid perithecia and in its larger ascospores.

Ellis obtained the specific name for this species from the older binomial, *Sporocybe calicioides* Fries (13) which he cites as a synonym. The description published by Fries is, however, clearly based on a hyphomycetous fungus, and there seems to be no reason for assuming the two fungi to be the same. The original material of Fries is, according to Juel, not now present in the herbarium at Upsala, and has probably been lost. Since Ravenel[2] distributed material of the fungus of Ellis under the name *Sporocybe calicioides* Fries, this name is cited in the synonomy above with an interrogation mark.

MATERIAL EXAMINED

Ravenel's Fungi Caroliniani 1: 83 (specimen in herbarium Harvard Univ.); specimen collected by Suksdorf (No. 256) in Washington territory and sent to Ellis by C. G. Sprague, Dec., 1883. (Ellis Herb. N. Y. Bot. Gard.); specimen in Ellis' herbarium labeled in his handwriting *Hypsotheca calicioides* (Fr.) var. *caespitosa* n. var. (No. 71, March, 1891, on decaying poplar log).

2. **Caliciopsis subcorticalis** (Cooke & Ellis) comb. nov.

Sphaeronema subcorticale Cook & Ellis, Grev. **6**: 83. 1878.
Calicium ephemerum Zwackh, Lichenen Heidelbergs p. 81, 1883.
Hypsotheca subcorticalis (Cooke & Ellis) Ellis & Everhart, Jour. Mycol. **1**: 129. 1885.
Hypsotheca ephemera (Zwackh) Sacc., Syll. Fung. **10**: 72. 1891.
Caliciopsis ephemera (Zwackh) Rehm, Rabenhorst Kryptogamen Flora 1^3: 388. 1896.

ILLUSTRATIONS: E. & E. North American Pyrenomycetes *pl. 22. figs. 1–5.*

TYPE: Herb. Cooke, No. 2743, Royal Botanic Gardens, Kew. Portion of this deposited in Fitzpatrick herbarium as No. 1738

(Figures 37, 38)

Mycelium apparently saprophytic in the cortical tissue of oak; stromata small, approximately 0.3 mm. in diameter, scattered, usually hidden in the crevices of the bark, bearing a cespitose cluster of pycnidia and perithecia, the perithecia protruding at maturity from the crevices in the bark as minute, slender, black spines; perithecium glabrous, dull to shiny, reaching 1.5 mm. in length, when young probably coriaceous and white within, in age or in dried specimens becoming brittle and easily broken away, consisting of a long stalk, a median or sub-apical enlargement containing the ascigerous cavity,[3] and a terminal beak; the enlargement sub-cylindrical-vesiculose, 200–325 μ long and reaching 150 μ in lateral diameter at the middle, sometimes laterally collapsed as in *C. pinea* but not inclined to one side as frequently happens in that species; the stalk long, slender, 80–125 μ in diam., cylindrical, straight to flexuous, swollen at the point of attachment to the stroma; beak of approximately the same diameter as the stalk, occasionally attenuated toward the tip especially when young, in some perithecia exceeding 500 μ in length, traversed by a narrow canal; the apex in immature stages sharp-pointed, closed, at maturity becoming minutely fimbriate-lacerate, and having a reddish-brown, fuzzy appearance, finally dehiscent, the terminal hairs spreading apart and forming a fringe around a definite opening; asci ovate to clavate, 12–15 $\times$ 7–9 μ (p. sp.), spores ellipsoidal to oval or globose, 3–4 $\times$ 4–5 μ; pycnidia approximately 100 μ broad; pycnospores 2.5–3.5 μ long.

[3] In the specimen of E. & E. N. A. F. 2nd series No. 2123 in Professor Thaxter's herbarium at Harvard University one abnormal and unusually long perithecial stalk was observed which had developed a half-dozen lateral buds, apparently containing ascigerous cavities.

Found by Ellis at Newfield, N. J., on loosened pieces of bark, on dry, decaying oak limbs lying on the ground. Reported by Rehm (41) from Heidelberg, Germany, on the young, lower branches of oak. Only the American material has been examined by the writer. In the present state of our knowledge there is no reason to assume that the species is parasitic. The material distributed by Ellis[4] bears on the label of the packet the statement that the fungus is parasitic on old *Dichaena strumosa* Fr. on *Quercus coccinea*. An examination of the specimen leads the writer to feel that the presence of the *Dichaena* on the bark is merely incidental, and that there is no reason for assuming that the *Caliciopsis* is parasitic on it. The label accompanying the type material makes no reference to a parasitic condition or to *Dichaena*. Moreover Ellis makes no such reference in the published descriptions of the species (9, 10, 11). Only a very small amount of material has been available for examination, and the writer has not seen the species in nature. In as far as he is aware only the two collections made by Ellis at Newfield, N. J., in 1877 and 1883, are known for America.

Rehm (41) discusses this species under the name *Caliciopsis ephemera* (Zwackh) Rehm, though stating that he examined North American material[4] of *Hypsotheca subcorticalis* and found it to be identical with *Calicium ephemerum* Zwackh.[5] Since the description of *Sphaeronema subcorticale* C. & E. antedates that of Zwackh (57) by five years, it is clear that the specific name applied by Zwackh cannot be maintained. Rehm, however, states that Zwackh in his description of *Calicium ephemerum* cites *Stilbum rugosum* Fries and *Coniocybe Beckhausii* Körber (26) as synonyms. The papers of Zwackh and Körber are both unavailable to the writer, but according to Rehm, Körber failed to find asci in *Coniocybe Beckhausii*. A citation of the place of publication of *Stilbum rugosum* Fries is not given by Zwackh (57), Rehm (41), or Saccardo (45), and apparently an error has occurred in the publication of this name. Professor O. Juel states in a letter to the writer that no specimen bearing this

[4] E. & E. N. A. F. 2nd series No. 2123.
[5] Lichenes exsiccati No. 477.

name exists in the herbarium at Upsala, and that a careful search fails to disclose the use of the name in any of the writings of Fries. In the present state of our knowledge neither *Stilbum rugosum* Fries nor *Coniocybe Beckhausii* Körber can logically be included in the synonomy of the species here described. Although the writer has not seen a specimen of the material of *Calicium ephemerum* distributed by Zwackh,[5] the name is included above in the synonymy because Rehm has seen this material and has pronounced it identical with the American specimens distributed by Ellis.

MATERIAL EXAMINED

Herb. Cooke, No. 2743 (*type* collection of *Sphaeronema subcorticale* C. & E., Royal Botanic Gardens Kew; fragment of this preserved as Fitzpatrick Herb. No. 1738); Ellis and Everhart, N. Am. Fungi, 2nd series, No. 2123 (Underwood Collection at N. Y. Bot. Gard.; also in Herb. R. Thaxter at Harvard Univ.).

3. CALICIOPSIS PINEA Peck, Ann. Rept. N. Y. State Mus. Nat. Hist. **33**: 32. *pl. 2. figs. 11–15.* 1880, and in Bull. Torr. Bot. Club **9**: 62. *pl. 24. figs. 8–12.* 1882

Calicium stenocyboides Nylander, Flora **65**: 451. 1882.

Cyphelium stenocyboides (Nylander) Arnold, Lichenes Monacenses Exsiccati, No. 417, 1895.

Caliciopsis stenocyboides (Nylander) Rehm, in Rabenhorst Kryptogamen Flora 1^3: 389. *figs. 1–4.* 1896.

ILLUSTRATIONS: Peck, Ann. Rept. N. Y. State Mus. Nat. Hist. **33**: *pl. 2. figs. 11–15;* Bull. Torr. Bot. Club **9**: *pl. 24. figs. 8–12;* Rev. Mycol. **4**: *pl. 29. fig. 7;* Rehm in Rabenhorst Kryptogamen Flora 1^3: 383. *figs. 1–4.*

TYPE: In the herbarium of Peck at Albany, N. Y. Material of original collection also in herbarium at New York Botanical Garden. Both specimens studied by writer, and permanent slides showing mature asci, ascospores, and pycnospores deposited in his herbarium as No. 1688.

(Figures 33, 34, 48)

Mycelium parasitic[6] in the trunk and branches of pine, causing the formation of sharply delimited, depressed areas (cankers) in the cortical tissue; these cankers frequently several inches in diameter and characterized by a smoother surface and more reddish color than the surrounding bark; stromata numerous, more or less definitely circular, scattered over the canker, several occasionally confluent, minute, scarcely visible, each entirely covered with a cespitose cluster of pycnidia and perithecia, 0.5–1.0 mm. in diameter, occasionally smaller bearing only one or two fruit-bodies; pycnidia usually preceding the perithecia, but both often found on the same stroma; perithecia appearing to the naked eye as fascicles of black spines arising from the surface of the bark; perithecium glabrous, dull to shiny, reaching 2 mm. in height, when young white within and coriaceous, in age or in dried specimens becoming brittle and easily broken off, long-stipitate, the ascigerous cavity developed within a terminal urceolate swelling which at maturity is frequently laterally collapsed, and curved or inclined to one side, resembling strikingly the capsule in certain mosses (genus *Hypnum*); occasionally the apex of the stalk forked and bearing two or even three terminal ascigerous swellings; the stalk long, reaching 1600 μ, slender, 100–140 μ in diam., cylindrical, either straight or definitely curved to one side, not flexuous, swollen at the base; the perithecium reaching almost its full length before the terminal ascigerous swelling is formed, and in immature stages appearing as a sharp-pointed spine of uniform diameter; the terminal enlargement at first clavate, 400 μ long $\times$ 175–275 μ wide, closed; at maturity the apex of the swelling becoming fimbriate-lacerate and assuming the reddish-brown, fuzzy appearance seen in several other members of the family, finally dehiscent, the terminal tuft of hairs spreading apart and forming a fringe around a definite opening; asci ovate, 12–17 $\times$ 5–8 μ (p. sp.), spores ellipsoidal to ovoidal or globose, 3.5–6 $\times$ 2–4 μ; pycnidia 100–150 μ; pycnospores 2.5–3.5 μ long.

Parasitic[6] on *Pinus strobus* in eastern North America. Found on *P. rigida* in New Jersey by Ellis, and reported from Germany by Rehm (41) on *Pinus pumilo* and on fir. The material on *Pinus pumilo* distributed by Arnold[7] under the name *Cyphelium stenocyboides* has been examined by the writer and is

[6] The statement that the species is parasitic is based wholly on field observations on *Pinus strobus*, and is not yet supported by artificial infection experiments.

[7] No. 417 Lichenes Monacensis exsiccati.

identical with American material of *Caliciopsis pinea*. No material on fir has been seen by the writer, but Rehm reports its collection on this host at Heidelberg. One of the specimens[8] cited by Rehm (**41**) has been unavailable to the writer and probably contains the material collected on fir.

MATERIAL EXAMINED

New York: *type* material collected at Charlton by Chas. Peck (in Peck Herb. Albany, N. Y.; also in Herb. N. Y. Bot. Gard.); Fitzpatrick Herb. Nos. 1664, 1665, 1669, 1726, and 1739 (material collected at various points near Ithaca).

New Jersey: Herb. C. E. Fairman No. 2004 (material collected Apr. 1889 at Newfield by Ellis on *Pinus rigida;* other material of same collection in Ellis Herb. at N. Y. Bot.); another specimen in Ellis Herb. collected by him at Newfield, Dec. 12, 1881, probably also on *Pinus rigida.*

Massachusetts: Material collected at Manchester by W. C. Sturgis, Oct. 1888 (Herb. C. E. Fairman No. 2002, and three packets at N. Y. Bot. Gard. labeled "ex. Herb. Seymour"); material collected by Sturgis at Manchester, Nov. 1888 (two packets at N. Y. Bot. Gard. labeled "ex. Herb. W. G. Farlow"); material collected by Sturgis at Manchester, Dec. 8, 1888 (E. & E. N. Am. Fungi No. 2382 in Herb. C. E. Fairman, and at N. Y. Bot. Gard.).

Pennsylvania: Herb. Fitzpatrick No. 1792 (material collected at Stone Valley, June 12, 1920).

Vermont: Herb. C. G. Pringle No. 300 (in Herb. W. G. Farlow at Harvard Univ., in Peck Herb. Albany, N. Y., and Fitzpatrick Herb. No. 1741). Material collected by Pringle at Charlotte.

Germany: Arnold, Lich. Monoc. Exsic. No. 417 (in Herb. Harvard Univ.) on *Pinus pumilo.*

2. SORCIA Giesenhagen, Ber. Deut. Bot. Gesell. **22:** 191–196. *pl. 13.* 1904

Capnodiella Saccardo, Syll. Fung. **17:** 621. 1905 (Syll. Fung. **1**: 74. 1882, as subgenus).

[8] v. Zwackh-Holzhausen, Lichenes exsiccati No. 686.

Type speciēs, *Capnodium maximum* Berk. & Curt.

Stromata, black or dark-brown, formed within the living leaves of the host, later erumpent, bearing pycnidia and perithecia; perithecium black, coriaceous, very long-stalked, the ascigerous portion clavate, tapering into a long, beak-like neck traversed by a canal; apex at first closed but at maturity fimbriate-lacerate, a definite opening finally resulting; proliferation of the perithecium taking place after the escape of the ascospores, the stalk of a second perithecium arising as a continuation of the beak-like neck of the first and emerging from the opening at the tip of the beak; the second perithecium long-stalked and in every way identical with the first; by the repetition of this phenomenon as many as five perithecia formed in linear series; two perithecia occasionally arising from one opening, a definite fork thus being formed; asci ovate, very long-stalked, thin-walled, evanescent, 8-spored, aparaphysate; ascospores spherical to sub-ellipsoidal, thin-walled, brown, unicellular; pycnidia borne on the stroma among the perithecia, sessile or short-stipitate, globose, black; pycnospores hyaline, fusiform, unicellular.

Resembling *Caliciopsis* in asci, ascospores, pycnidia, and pycnospores, and differing from that genus essentially only in the possession of the phenomenon of proliferation. The method of dehiscence of the perithecium is identical with that found in *Caliciopsis, Tripospora tripos,* and *Corynelia fructicola.*

The subgenus *Capnodiella* of the genus *Capnodium* Montagne was erected by Saccardo (**45**) to include the single species *Capnodium maximum* Berk. & Curt., which differs from other members of the genus in having unicellular ascospores. Later the subgenus, still containing the single species, was raised by him (Saccardo **45**) to generic rank. Meanwhile Giesenhagen (**15**) studied material of the same fungus, and failing to recognize it as *Capnodium maximum,* founded the genus *Sorica* upon it. He named the species *S. Dusenii* but later (**16**) having learned of his error, changed the name to *S. maxima* (Berk. & Curt.) Giesenhagen. The genus *Sorica* is placed by him in the Sphaeriaceae-Phaeosporeae of Saccardo, though he regards it as of doubtful relationships. He suggests the possibility of including it in the Xylariaceae or in the Ceratostomataceae. Von

Höhnel (**21**) includes *Capnodiella* in his enumeration of the genera of the Capnodiaceae, but subsequently (**22**) states that the genus is in reality a member of the Coryneliaceae. He feels that it is closely related to *Corynelia,* differing from that genus chiefly in the long stalk of the perithecium. Finally Stevens (**49**) describes the fungus as new under the name *Corynelia pteridicola Stevens.* The writer has examined several collections of this fungus, and agrees with von Höhnel and Stevens that the species should be included in the Coryneliaceae, but he feels that it differs sufficiently from all the known species of *Corynelia* to warrant its exclusion from this genus. The genus *Sorica* is therefore recognized for it. Patouillard and Gaillard (**35**) state that the species is closely related to *Capnodium arrhizum* Pat. & Gail., a fungus found by Gaillard in Venezuela on dead leaves lying on the ground. All the material of the original collection of this latter species was deposited in the herbarium of Gaillard, the collector. Patouillard has written to the writer stating that he has never had material of the species in his own herbarium, and that he does not know what became of the herbarium of Gaillard after the latter's death. The original material of *Capnodium arrhizum* must be considered, therefore, as unavailable if not actually lost. A study of the figures and description given by the authors of the species, has convinced the writer, however, that this fungus is very different from *Sorica maxima,* and clearly not a member of the Coryneliaceae.

1. SORICA MAXIMA (Berk. & Curt.) Giesenhagen, Ber. Deut. Bot. Gesell. **22**: 355–358. 1904

Capnodium maximum Berk. & Curt., Jour. Linn. Soc. Bot. **10**: 391. 1869.

Sorica Dusenii Giesenhagen, Ber. Deut. Bot. Gesell. **22**: 191–196. *pl. 13.* 1904.

Capnodiella maxima (Berk. & Curt.) Saccardo, Syll. Fung. **17**: 621. 1905.

Corynelia pteridicola Stevens, Illinois Acad. Sci. Trans. **10**: 179–181. *fig. 6.* 1917.

ILLUSTRATIONS: Giesenhagen, Ber. Deut. Bot. Gesell. **22**: *pl. 13.* 1904; Stevens, Ill. Acad. Sci. Trans. **10**; *fig. 6.* 1917.

TYPE: in the herbarium of Berkeley, at the Royal Botanic Gardens, Kew, England; co-type material in the herbarium of Curtis at Harvard University. Both of these have been examined by the writer, and a portion of the type is deposited in his herbarium.

(Figures 30–32, 49)

Mycelium parasitic in the leaves of the host, localized, confined to a small area surrounding the point of infection, forming a definite stroma within the host tissue; stromata in some collections of material scattered irregularly over the leaf, in others confined to the sori, the general appearance of the fungus on the host in the two cases consequently very different; the stroma when formed in the sorus not well-developed, buried from sight below the mass of host sporangia, not spreading to the other host tissues, usually not forming a spot in the leaf, and never observed to result in its perforation; perithecia arising as black bristles among the host sporangia and radiating in every direction; stromata when formed in other portions of the leaf erumpent, usually hypophyllous, at first minute, gradually increasing in area, the central portion soon falling out, leaving only the opposite epidermis or more often a complete perforation; the hole thus formed in the leaf reaching 3–4 mm. in diameter, surrounded by an annular or ring-shaped stroma, less than 1 mm. in width, and of the thickness of the leaf or slightly thicker; stromata from the first bearing numerous pycnidia and perithecia; later when the hole appears in the leaf the perithecia forming a ring of bristles around the perforation and arising from the annular stroma on both the upper and lower surfaces; perithecium shiny to dull, 1–1.5 mm. long, stalk 35–50 μ thick, the ascigerous portion glabrous, 125–150 μ in diam. $\times$ 250 μ in length, tapering into a glabrous beak-like neck, 200–350 μ long; stalk frequently hairy with brown hyphae; asci 15–17 $\times$ 10 μ (p. sp.), ascospores 5–6 $\times$ 4–5 μ; pycnidia covered with brown hairs like those on the stalk of the perithecium; pycnospores 11–24 $\times$ 4 μ.

Parasitic on *Polypodium* (*Campyloneurum*) *phyllitidis, P. punctatum, P. crassifolium, P. Schomburghianum* and probably other species in Cuba, Porto Rico, San Domingo, Brazil, Ecuador, Venezuela, and probably other neighboring countries.

Giesenhagen (**15**) states that the brown hairs which clothe the pycnidium and the stalk of the perithecium are conidial bearing

and he figures a cluster of very minute conidia at the tip of one of these hairs. His observations have not been corroborated by the writer.

Seven specimens of this fungus have been examined by the writer. In five of these the fungus occurs exclusively in the sori; in the other two, sori are absent and the stromata are scattered irregularly over the leaf. The general appearance of the fungus in the two cases is different, but the perithecia, asci, and spores are identical. Giesenhagen saw both forms of this species and suggests that the fungus more often occurs in the sorus because the outer wall of the epidermal cells of this structure in the young condition is thin and permits of easy penetration, while the cuticle covering the other cells offers greater resistance. He states that when the stromata are formed on the leaf outside of the sori they border wounds caused by biting insects. The observations of the writer and those of Stevens show that the holes in the leaf are caused by the advance of the fungus rather than by the biting of insects, and infection apparently occurs on the uninjured epidermis. The condition or age of the host at the time of infection probably determines the type of tissue attacked. It seems best in the present state of our knowledge to regard all the material as representing one species. It is of interest to record that the type material of Berkeley shows the fungus in the sori, while the original specimens upon which Stevens based his description of *Corynelia pteridicola* show the annular stromata scattreed over the leaf surface.

MATERIAL EXAMINED

Porto Rico: Herbarium University of Illinois, Porto Rican Fungi No. 3551 (material cited by F. L. Stevens as the *type* of *Corynelia pteridicola;* communicated by him).

San Domingo: Herbarium of the Experiment Station of the Board of Commissioners of Agriculture, Rio Piedras, Porto Rico, No. 1021a (material collected April 7, 1913 by J. R. Johnston at La Romana, communicated by J. A. Stevenson, and deposited as Fitzpatrick Herb. No. 1528).

Cuba: Fungi Cubenses Wrightiani No. 786 (*type* material of *Capnodium maximum* B. & C. from the herbarium of Berkeley

Kew, England; also *co-type* material from the herbarium of Curtis at Harvard University).

Brazil: Rehm, Ascomycetes No. 1817 (in herb. New York Bot. Gard.; also in herb. C. E. Fairman). See Ann. Mycol. **7**: 138. 1909.

Ecuador: Herbarium of Patouillard (collected by Sodiro at Puente de Chimbo; communicated by Patouillard).

3. TRIPOSPORA Saccardo, in Berlese et Voglino, Additamenta Syll. Fung. p. 194. 1886

Type species, *Corynelia tripos* Cooke.

Stromata black, pulvinate, amphigenous and caulicolous, rounded to elongated, formed within the host tissue, later erumpent, not irregularly scattered, arranged definitely in rows and becoming confluent, bearing compact clusters of perithecia; perithecium flask-shaped with a globose to ovoidal ascigerous portion seated on the stroma and a long, cylindrical neck, which in the young condition is rounded at the apex and closed; at maturity the apex of the neck flattening into a disc which becomes fimbriate-lacerate; finally the margin of the disc recurving to give a wide funnel-shaped opening; asci as in *Corynelia*, ovate, long-stalked, thin-walled, evanescent, 8-spored, aparaphysate; ascospores very characteristic, star-shaped, consisting of 4 (rarely 5) conical, sharp-pointed projections radiating from a rounded central portion, hyaline when young, becoming dark-brown, at maturity opaque and nearly black, thick-walled, unicellular.

Differing from *Corynelia* chiefly in the shape of the spores. The general appearance of the perithecium is very similar to that of *Corynelia fructicola*.

1. TRIPOSPORA TRIPOS (Cooke) Lindau, in Engler und Prantl, Die Natürliche Pflanzenfamilien 1^1: 413. 1897

Corynelia tripos Cooke, Grev. **8**: 34. 1879.

Tripospora Cookei (Cooke) Saccardo, in Berlese et Voglino, Additamenta Sylloge Fungorum, p. 194. 1886.

ILLUSTRATIONS: Winter, Ber. Deut. Bot. Gesell. **2**: figs. *1–3;* Lindau, in Engler und Prantl, Die Natürliche Pflanzenfamilien 1^1: *figs. 261 f. h. j.*

TYPE: in herbarium of Cooke at Kew, England, Miss E. M. Wakefield has compared the type with the specimen of No. 3150

Rabenhorst-Winter, Fungi europaei at Kew, and states that they are the same, the latter being in fact co-type material. The writer has seen material of this exsiccati number in four different herbaria, and the accompanying photographs and drawings were made from that in the herbarium at Cornell University.

(Figures 22–25, 44, 45)

Stromata bearing a compact cluster of perithecia, 0.5–1.5 × 0.5 mm., not irregularly scattered, arranged definitely in rows and becoming confluent; these rows reaching sometimes a length of 10 mm. (15–20 mm. acc. Winter **55**), but usually shorter, several rows frequently formed on the surface of one leaf; perithecia occurring on the stroma in a compact cluster of 2 to 16 (usually 4–8, and on isolated stromata radiating toward all sides, so oriented when the stromata form a row that they point to the left and right, the appearance of the fungus thus becoming regular and very beautiful; young perithecium definitely flask-shaped, with a roughened, spherical to ovoidal, ascigerous, basal portion and a long, cylindrical, glabrous, shiny neck which is rounded at the tip and blunt; the neck of the perithecium in early stages provided with a canal and marked at the apex with a minute umbilicus, but closed; in later stages the apex of the beak flattened to form a slightly convex disc, the diameter of which equals that of the ascus-bearing portion of the perithecium; this disc becoming fimbriate-lacerate, and assuming a reddish-brown, fuzzy appearance, finally definitely dehiscent, the margin recurving, exposing the lighter colored inner wall of the neck of the perithecium and resulting in the formation of a broad, funnel-shaped cavity, the center of which is usually filled with a black mass of spores; immature asci, 30–35 × 40–60 μ (p. sp.), mature asci containing opaque spores not observed; ascospores 22–34 μ in diameter (measured from tip to tip of adjacent projections).

Parasitic on the leaves and green parts of the stem of *Podocarpus elongata* and *P. Thunbergii* in South Africa, and of *P. Lamberti* in Brazil. Not known to the writer on other hosts or from other localities. The species has long been known from South Africa and is not uncommon there. It was collected in Brazil by Ule and recorded by Rehm (**42**). The material from Brazil available for examination differs from the South African material in having a slightly larger, rougher, and longer-necked perithecium. In other respects the two are alike.

Winter states that on account of the opaqueness of the mature ascospores it is not possible to determine whether the conical projections are cut off by septa from the rounded central portion. The writer has seen no indication of the presence of septa, and regards the spores as unicellular at all stages.

MATERIAL EXAMINED

Cape Province, S. Africa: Rabenhorst-Winter, Fungi europaei No. 3150 (*co-type:* one specimen in herb. Plant Path. Cornell Univ., two in herb. New York Bot. Gard., one in herb. Rehm, Stockholm, Sweden); Union Department of Agric., Mycological herb. No. 7355 (communicated by Ethel M. Doidge).

Natal, S. Africa: herbarium Fitzpatrick No. 1563 (col. Miss A. V. Duthie, communicated by Doctor van der Bijl of Berea Durban).

Brazil, S. America: herbarium Rehm Nos. 1744 and 1747 (col. Ule at Serra Geral, communicated by L. Romell of Riksmuseum, Stockholm, Sweden; fragment and slides preserved in Fitzpatrick Herb. as No. 1579).

(To be concluded in the September number)

EXPLANATION OF PLATES

PLATE 12

Corynelia portoricensis

Fig. 1. Clusters of perithecia on leaves of *Podocarpus coriaceus*. × 2¾.

Fig. 2. A cespitose cluster of perithecia arising from a single stroma. Various stages in the dehiscence of the perithecium are shown. × 11.

Fig. 3. Two clusters of mature but unruptured perithecia. Near the center of each cluster a single trilobed individual occurs. × 11.

PLATE 13

Fig. 4. *Corynelia brasiliensis.* A stellate cluster of mature but unopened perithecia. The stroma appears at the center of the cluster as a prominent cushion. × 11.

Fig. 5. *C. brasiliensis.* Two coalescent clusters of perithecia. Near the center of each cluster the stroma appears as a prominent cushion. The perithecia show in practically every case the last stage of dehiscence. × 11.

Fig. 6. *C. jamaicensis.* A cluster of unopened perithecia. Although the majority of the perithecia are trilobed, a single quadrilobed individual appears in the lower right hand portion of the figure. × 11.

Fig. 7. *C. jamaicensis.* A cluster of old weathered perithecia. The individuals have all opened, and the 3-pronged apices resulting from the spreading of the lobes show clearly at the center of the figure. × 11.

Fig. 8. *C. oreophila.* A stellate cluster of mature but unopened perithecia. The stroma appears at the center of the cluster as a roughened cushion. × 11.

Fig. 9. *C. oreophila.* A more typical cluster of perithecia. At the center of the group the surface of the stroma appears greatly roughened, due to the fact that new perithecia are beginning to form where others were earlier broken away. None of the perithecia in this cluster are in reality bilobed. Those individuals which appear bilobed have an additional lobe hidden from view. For demonstration of this fact compare this figure with Fig. 12. × 11.

Fig. 10. *C. oreophila.* A small group of perithecia, a single individual of which shows clearly the type of dehiscence characteristic of the species. × 11.

Fig. 11. *C. oreophila.* A stroma bearing seven perithecia, one mature, six immature. The tips of two of the young individuals have been broken away, exposing their white interiors. × 11.

Fig. 12. *C. oreophila.* The same cluster of perithecia shown in Fig. 9 photographed from a different angle. A careful comparison of the two figures will show that none of the perithecia are in reality bilobed. × 11.

PLATE 14

Fig. 13. *Corynelia uberata.* Clusters of perithecia on leaves of *Podocarpus Thunbergii.* × 2½.

Fig. 14. *C. uberata.* Clusters of immature perithecia. The tips of several individuals crushed and broken over in the lower cluster. × 11.

Fig. 15. *C. uberata.* A cluster of almost mature but unruptured perithecia, the apex of each traversed by several deep furrows. Dehiscence occurs later along the line of the middle furrow. × 11.

Fig. 16. *C. uberata.* A similar cluster of perithecia, but with many individuals broken away, exposing their white interiors. × 11.

Fig. 17. *C. uberata.* A small group of perithecia several individuals of which are wholly mature and show clearly the characteristic method of dehiscence by a single deep apical cleft. × 11.

Fig. 18. *C. uberata.* A copy of one of the illustrations published by Acharius in connection with the original description of this species in Observationes Mycologicae of Fries. Compare with Fig. 16. Magnification of original figure not given, but reproduced here as published.

Fig. 19. *C. nipponensis.* A cluster of mature but unruptured perithecia. Ruptured perithecia have not yet been seen but the presence of a single definite transverse furrow at the apex in many individuals indicates a type of dehiscence similar to that in *C. uberata.* × 11.

PLATE 15

Fig. 20. *Corynelia fructicola.* Numerous perithecia arising from stromata on the surface of a fruit of *Rapanea melanophloeos.* The stromata stand close together and tend to form a crust which frequently covers the whole sur-

face of the fruit. In this case the portion of the fruit most densely covered with stromata is equatorial. Many of the perithecia here visible at the periphery have the fuzzy terminal disc indicative of maturity. Compare with the same stage in *Tripospora tripos* shown in Figs. 23 and 25. × 11.

Fig. 21. *C. fructicola.* Same as Fig. 20 but showing clearly a cluster of immature perithecia at the top of the figure. In these the terminal disc has not yet been formed. × 11.

Fig. 22. *Tripospora tripos.* Clusters of immature perithecia on both surfaces of the leaf of *Podocarpus elongata.* The stroma shows clearly at the center of each cluster. × 11.

Fig. 23. *T. tripos.* Cluster of mature perithecia showing the fuzzy terminal discs indicative of maturity. Compare with same stage in *Corynelia fructicola* in Fig. 20. × 11.

Fig. 24. *T. tripos.* Mature and dehiscent perithecia. The apex of the perithecium appears as a funnel with a fuzzy brown margin and a throat filled with a black powder consisting of the spores. × 11.

Fig. 25. *T. tripos.* A few perithecia of the same age as those pictured in Fig. 23 shown in lateral view. × 11.

PLATE 16

Fig. 26. *Corynelia tropica.* A group of mature but unruptured perithecia. Material collected in Chile. × 11.

Fig. 27. *C. tropica.* A more elongated group of perithecia. Material a portion of the type collection (No. 1261. Rabenhorst, Fungi europaei) from Chili. × 11.

Fig. 28. *C. tropica.* A cluster of mature ruptured perithecia. The type of dehiscence is similar to that in other species in which a single apical cleft occurs, but here the resultant lobes have the fuzzy character of the disc in *Tripospora tripos.* Material collected in Chili. × 11.

Fig. 29. *C. tropica.* Clusters of immature perithecia from a collection of material made in the Philippine Islands. × 11.

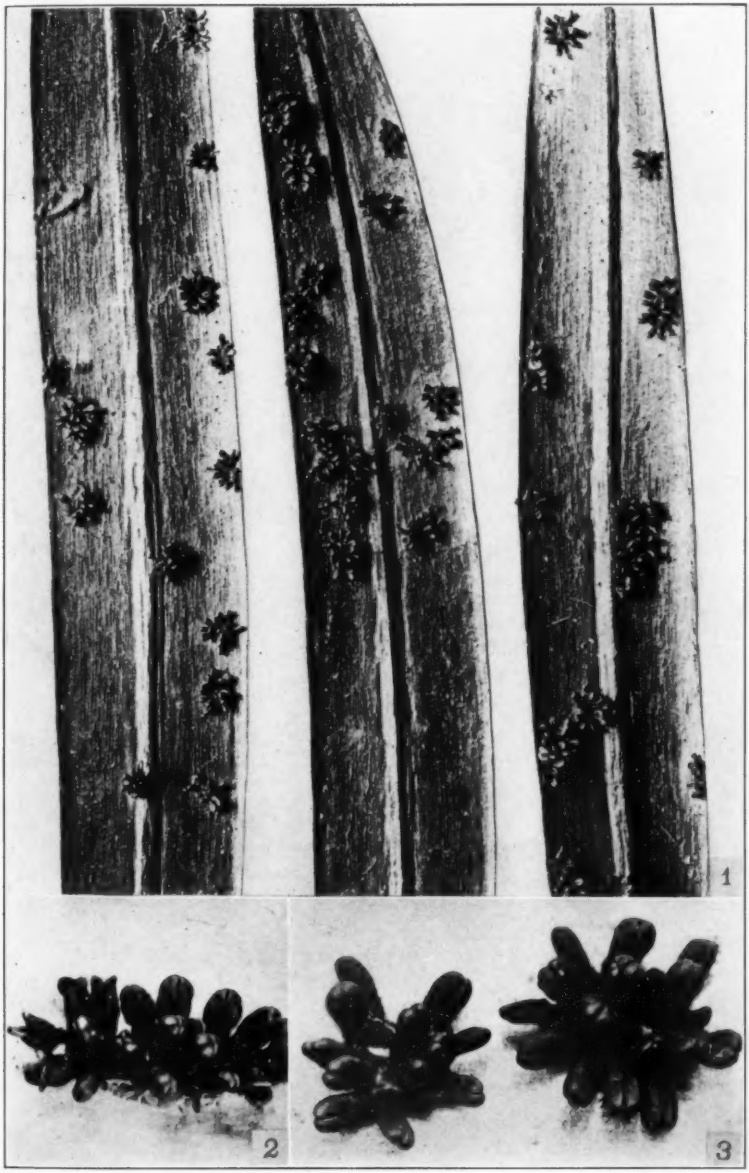
Fig. 30. *Sorica maxima.* Perithecia arising from an annular stroma bordering a perforation in the frond of *Polypodium.* As a result of proliferation several perithecia may be seen in linear series. Material photographed is a portion of the original collection on which Stevens founded *Corynelia pteridicola.* × 11.

Fig. 31. *S. maxima.* Perithecia arising from a stroma at the base of a sorus of sporangia on the leaf of *Polypodium.* These are the primary perithecia and proliferation has not yet taken place. Material photographed distributed by Rehm (Ascomyceten No. 1817) as *Capnodiella maxima.* × 11.

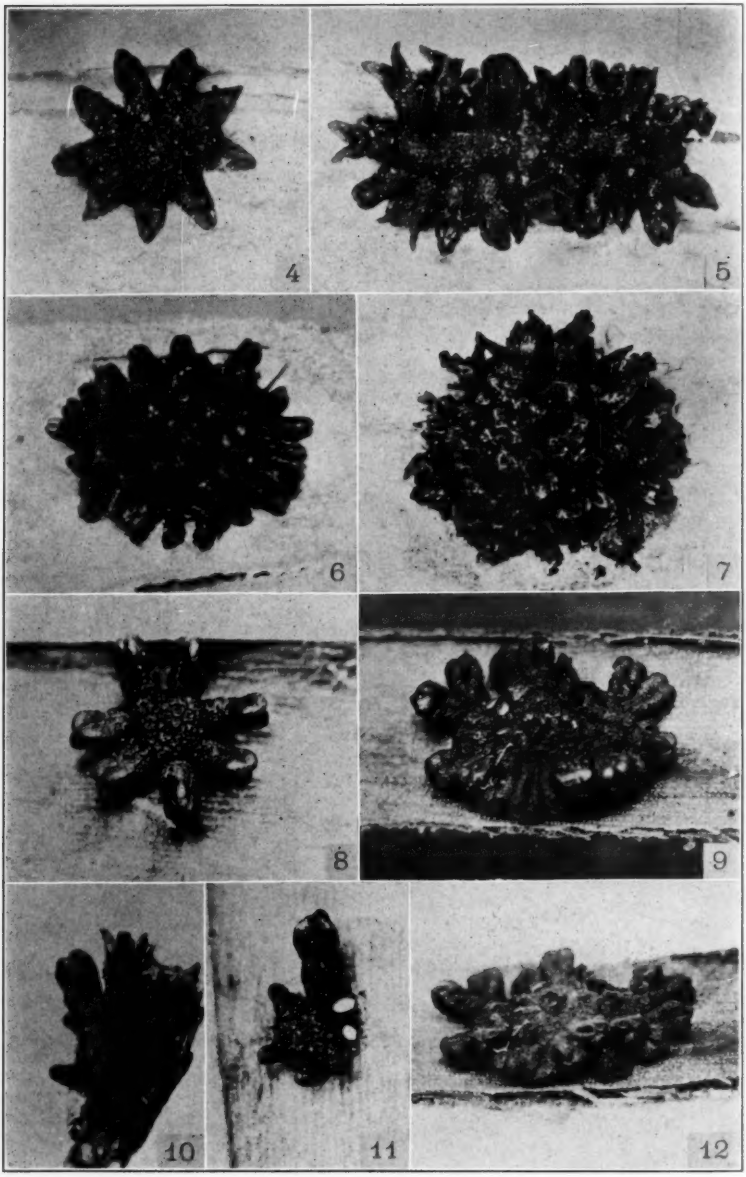
Fig. 32. *S. maxima.* Perithecia arising from a stroma at the base of a sorus of sporangia on the leaf of *Polypodium.* As a result of proliferation several perithecia are here shown in linear series. Material from Patouillard collected by Sodiro in Ecuador. × 11.

PLATE 17

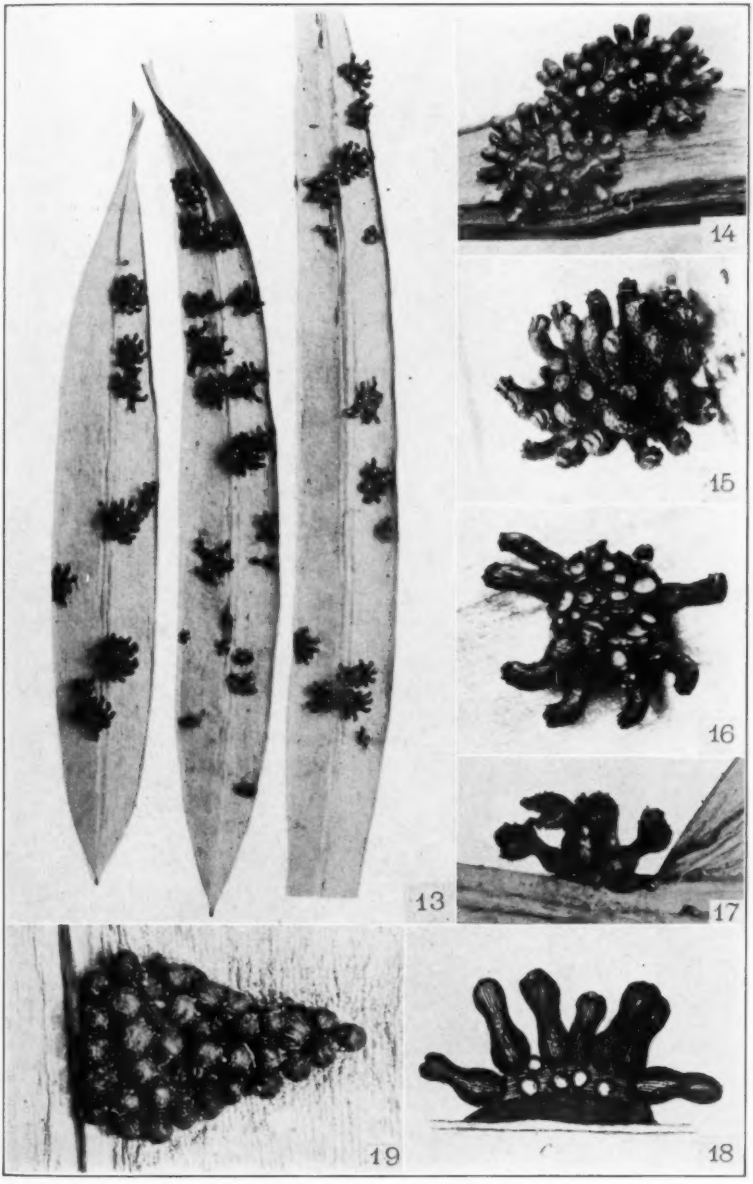
Fig. 33. *Caliciopsis pinea.* Perithecia arising from stromata on the bark of *Pinus strobus.* Type material from herbarium of Peck. × 11.



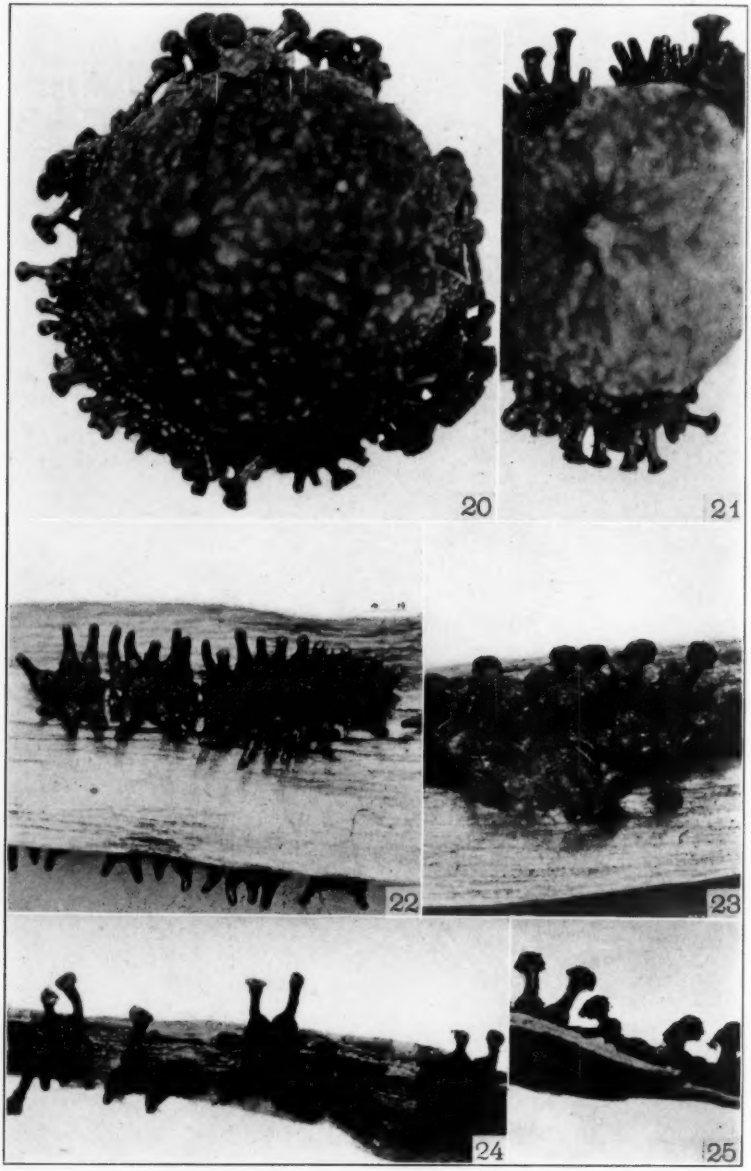
1–3. CORYNELIA PORTORICENSIS



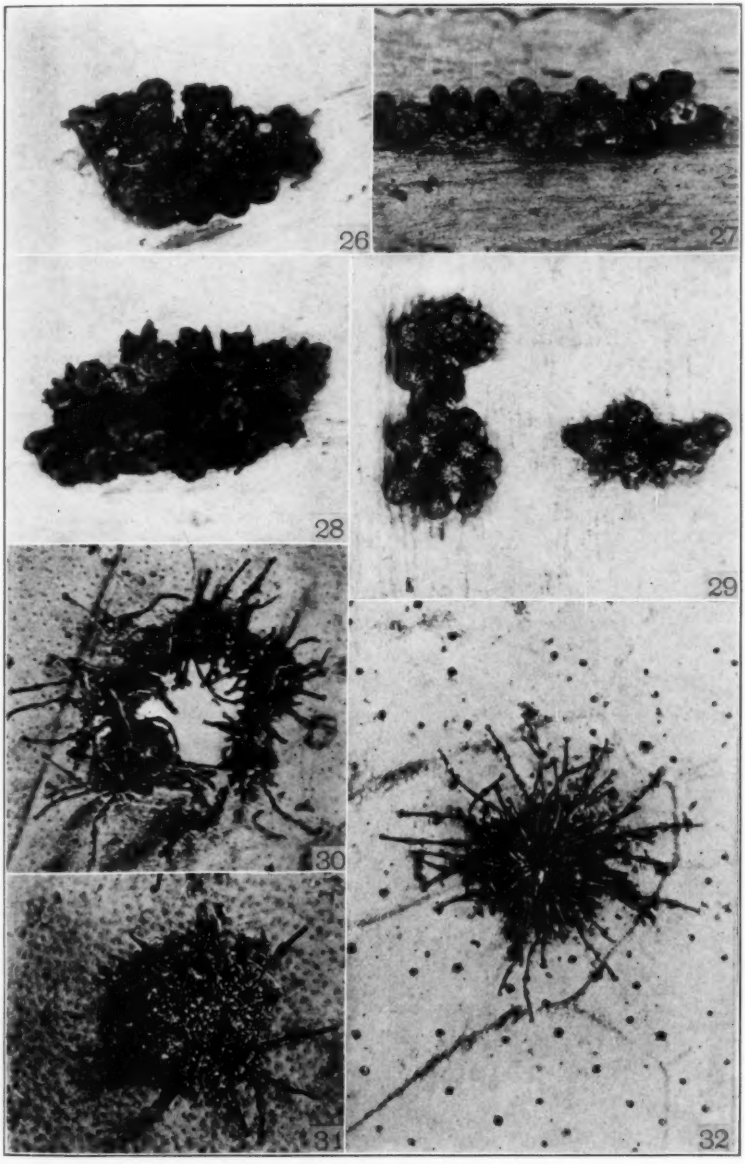
4, 5. CORYNELIA BRASILIENSIS
6, 7. CORYNELIA JAMAICENSIS
8–12. CORYNELIA OREOPHILA



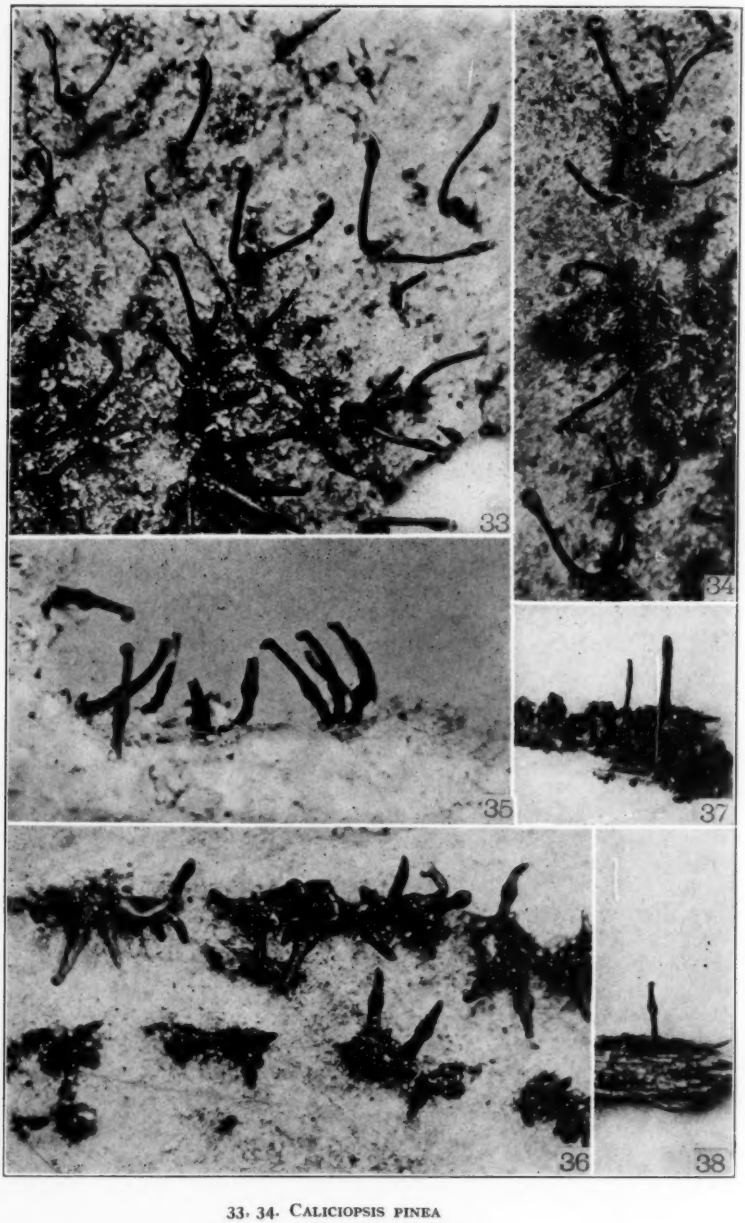
13–18. CORYNELIA UBERATA
19. CORYNELIA NIPPONENSIS



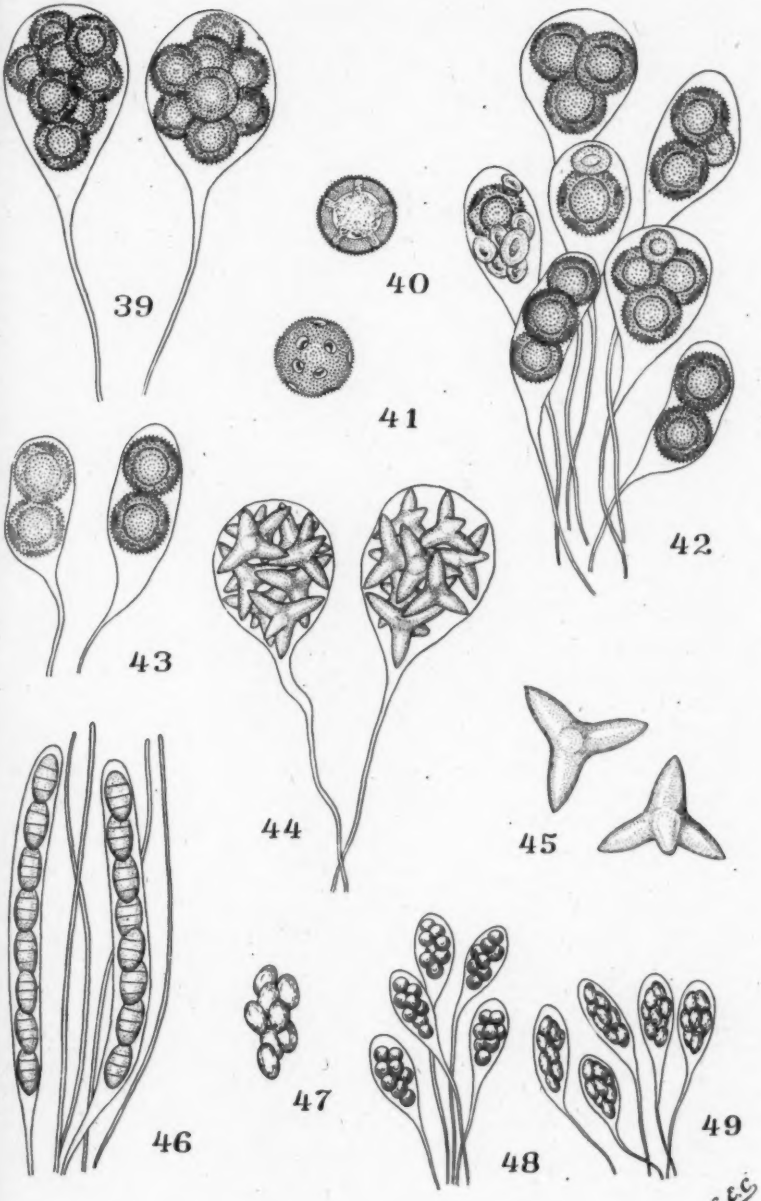
20, 21. CORYNELIA FRUTICOLA
22–25. TRIPOSPORA TRIPOS



26–29. CORYNELIA TROPICA
30–32. SORICA MAXIMA



33, 34. CALICIOPSIS PINEA
35, 36. CALICIOPSIS CALICIOIDES
37, 38. CALICIOPSIS SUBCORTICALIS



MICROSCOPIC CHARACTERS OF THE CORYNELIACEAE

Fig. 34. *C. pinea.* Mature perithecia showing method of dehiscence. Compare lowest perithecium with those of *Tripospora tripos* in Fig. 24. × 11.

Fig. 35. *C. calicioides.* Perithecia arising from stromata on bark of poplar. Type material collected in Washington by Sprague. × 11.

Fig. 36. *C. calicioides.* Perithecia arising from stromata on bark of decaying popular log. Material labeled in herbarium by Ellis as "var. caespitosa." × 11.

Figs. 37 and 38. *C. subcorticalis.* Perithecia arising from stromata on bark of oak. Type material from herbarium of Berkeley. The cespitose character lacking here was observed in other specimens not available for photographing. × 11.

PLATE 18

The drawings were outlined by the writer with the aid of a camera lucida. The details were then filled in under his immediate direction by his assistant, Mr. C. E. Chardon. A Bausch and Lomb 1.9 mm. oil immersion objective and a 7.5 ocular were used. As reproduced Fig. 39 and figures 42–49 represent a magnification of about 700. Figs. 40 and 41 represent a magnification of about 1000.

Fig. 39. *Corynelia oreophila.* Typical 8-spored asci containing mature spores.

Fig. 40. *C. oreophila.* A single ascospore shown in median optical section. Note the thin echinulate epispore, the thick endospore, and the germpores. Somewhat diagrammatic.

Fig. 41. *C. oreophila.* A single ascospore shown in surface view. The drawing represents the germ-pores as opening through the epispore to the outside, and in this respect is diagrammatic, since the epispore covers the pore until the time of germination.

Fig. 42. *C. portoricensis.* A group of asci containing mature spores. Note the variation in the shape of the ascus, and in the number of spores in an ascus.

Fig. 43. *C. bispora.* Typical 2-spored asci containing mature spores.

Fig. 44. *Tripospora tripos.* Immature asci.

Fig. 45. *T. tripos.* Two mature spores.

Fig. 46. *Coryneliella consimilis.* Asci and paraphyses. Ascospores mature.

Fig. 47. *Caliciopsis calicioides.* A group of eight mature ascospores.

Fig. 48. *C. pinea.* A cluster of asci containing mature spores. In this species the ascospores are sometimes sub-globose or broadly oval.

Fig. 49. *Sorica maxima.* A cluster of asci containing mature spores.